

THE IRON AGE

New York, August 3, 1916

ESTABLISHED 1855

VOL. 98: No. 5

The New Home of the Jacobs Chuck

A Hartford Factory Wherein the Skill
Required for Fine Machine Work
Finds Efficient Means for Expression

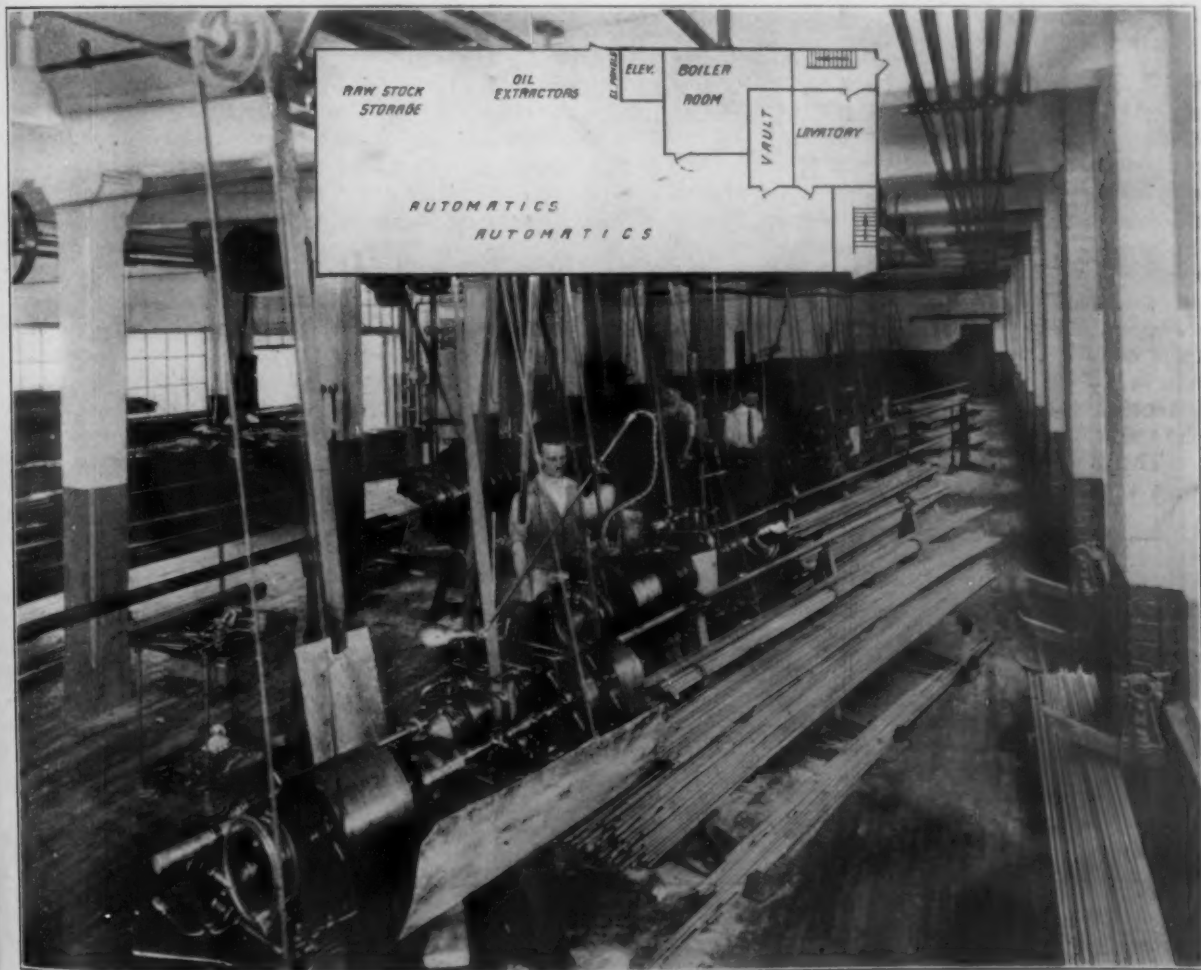
BY W. E. FREELAND

THE new plant of the Jacobs Mfg. Company, Park Street and Rowe Avenue, Hartford, Conn., is typical of the splendid type of new factories which are being built in response to the greatly increased demand for machine tools and appliances of standard reputation. The history of the Jacobs drill chucks is very similar to that of other highly developed specialties in the machine tool industry. The chuck was patented Sept. 16, 1902, by A. I. Jacobs and active manufacture was begun Oct. 1, 1903, in a small factory space on Pearl Street. The early policy, continued to this day, was to put out a quality product with the expectation that increased sales would follow the utilization of skill

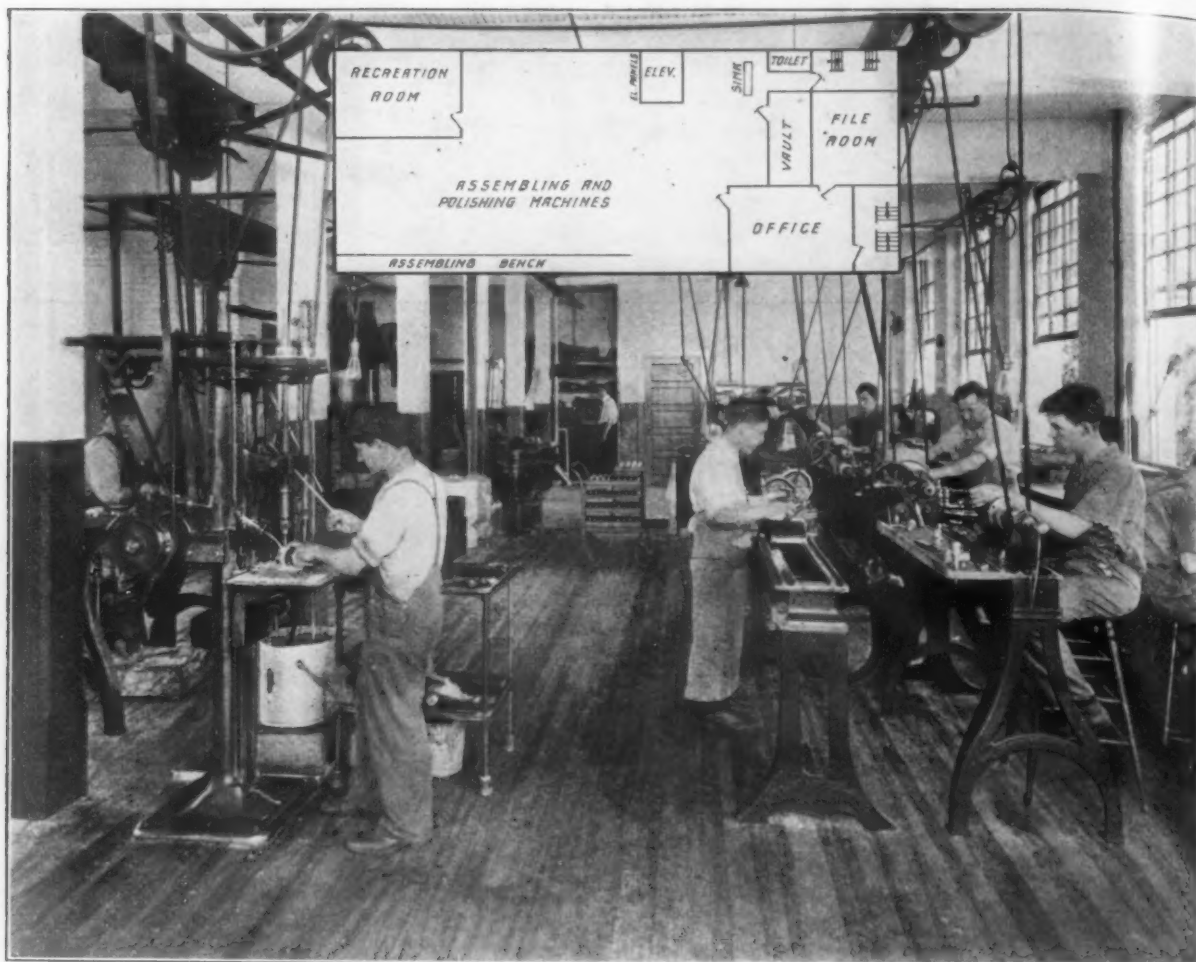
in tool making, exceeding care in the selection of raw stock and thorough inspection and rigid tests of each part in process.

Upon this solid foundation the business grew apace and in 1906 it became necessary to remove to larger quarters at 32 Union Place. Export sales became a large factor and the sudden rush of business a year or more ago found the plant cramped for room. Then the present site was bought for a new plant and a good engineering firm was called in to plan a factory which should embody all that modern designing could offer toward efficient production, safety and comfort.

The new factory is 42 x 106 ft. in plan, three



Two Rows of Automatics on the First Floor Equipped with New Britain Racks Which Hold the Stock for the Job in Process



A Corner of the Assembling Room on the Second Floor with the Entrances to the Office and Vault for Storing Finished Chucks and Parts in the Background

stories in height and is of slow burning mill construction. At two corners of the building are brick inclosed, fireproof stair wells with fire doors on each floor level and steel stairs with reinforced concrete treads. The exit doors at the ground level are equipped with so-called panic locks. The building is equipped with a sprinkler system and a noteworthy fireproof feature is found in the vaults on the two lower floors. The one on the first floor is used for the storage of jigs and fixtures and that on the second floor for finished parts and chucks. This latter feature is made possible and potentially profitable by the compact nature and the value of the finished product.

The boiler room occupies a space 16 x 20 ft., with an ell 8 x 8 ft., on the ground floor and is

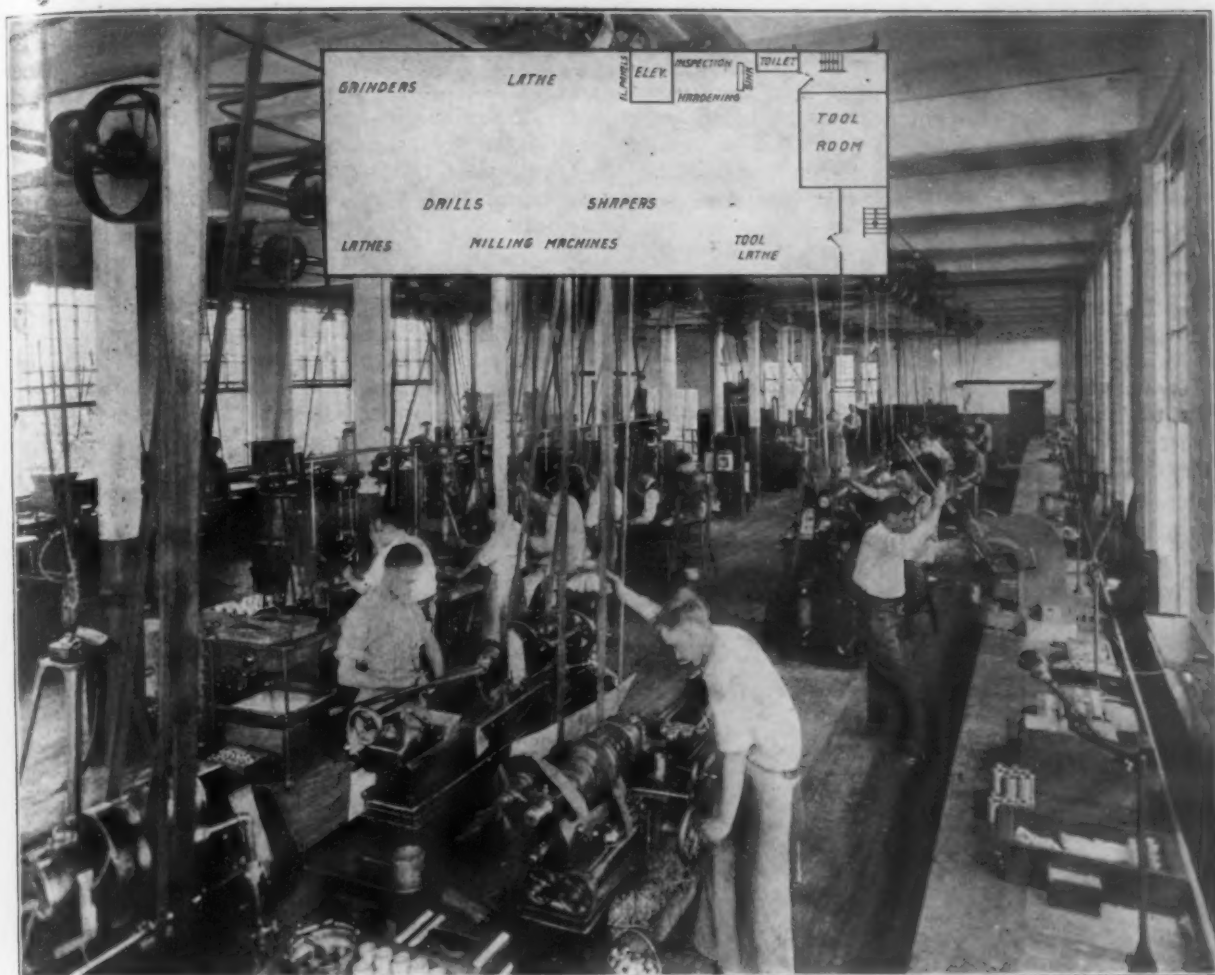


The Glass Shield Protecting the Operator from the Heat of the Furnace Is Composed of Two Pieces of Glass Separated by a 1-In. Opening To Give a Clear View of the Work

shut off from the other parts of the building by brick partitions. The boiler is used only for heating purposes, electric power being purchased for operating the machinery. The various motors are suspended from the ceiling and on each floor are inclosed switchboard panels. Many of the Hartford factories are notable for the care used in installing all electrical equipment. In this plant, for example, as shown in an accompanying illustration, all switches are inclosed to be as near foolproof as possible and all electrical mains and feeders are incased in iron pipe. All electric mains are painted black, sprinkler mains are red, hot water mains green and cold water mains blue. There are large incandescent lamps in reflectors on each alternate beam overhead for flood lighting and drop light circuits over each row of machines and the benches. The drop lights are attached to universal arm fixtures for greater convenience.

A capacious lavatory, which has toilet fixtures of porcelain and slate and is equipped with individual basins having both hot and cold water available, is located on the ground floor between the stairways. On the other two floors are smaller toilet rooms located near the head of the employees' stairs and long, deep enameled sinks with several hot and cold water faucets are placed nearby in the work-rooms.

A 3000-lb. elevator serves the three floors. A door in the side wall of the elevator well at the level of a truck body on the outside drive gives ready means for transferring loads from or to the elevator. An interesting feature of the elevator installation is the manner in which the counterweight is boxed in to prevent injury to the operator or others. It will be noticed in the illustration that



One Side of the Third Floor Showing the Arrangement of the Lathe and Milling and Drilling Machine Sections and Fireproof Stairhall in Background

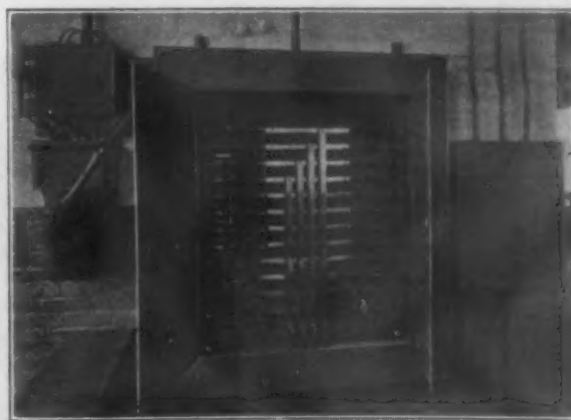
boards slightly separated cover the opening between the guides of the weight. Every alternate one is firmly bolted to the guides but the others are thinner and only lightly attached to the guides by two nails in each end, the heads of the nails being left slightly projecting so that these thinner boards can be quickly removed for the infrequent greasing of the guides.

The heating coils on the first floor are placed on the ceiling beams near the side walls. On the other two floors the heating coils are suspended on the side walls under the benches. Gas is used for heating the tempering furnaces. A large furnace with pyrometer attachment is placed in the boiler room and a small furnace on the top floor. For the protection of the operator against the heat of this small furnace there has been devised a glass shield which is illustrated herewith. As first made, this shield was one plate of glass, but the condensation of moisture made much bother which was eliminated by making the shield of two pieces of glass separated a little over 1 in., the open space permitting clear observation of the small pieces being treated.

The working space on the first floor is given over to the storage of bar stock and to the automatics which play so important a part in the manufacture of drill chucks. The bar support of each automatic forms the top member of a New Britain rack, which has arms holding the stock for the job in process. This factory is unusually liberal to its machinists in the matter of clean waste as it has found that all the waste from the two upper floors after it has become too dirty for use there has a further extension of service in cleaning bars for

the automatics. After the work leaves the automatics and is cleaned it is carried in tote boxes to the upper floor where the final machining work is performed.

This third floor is arranged so that there shall be as little travel as possible for each part that enters into the final assembly of the chucks and ample space has been provided about each machine for movement of trucks and for work tables. This feature is perhaps more noticeable in some of the newer plants in New England because in this section more, perhaps, than in any other part of the country one constantly runs across old plants where the great need for prompt and high production at this time has been solved temporarily by the crowd-



The Electrical Equipment Is Carefully Installed with the Wiring Run in Iron Conduit and the Power Switches Inclosed To Prevent Manipulation by Unauthorized Persons

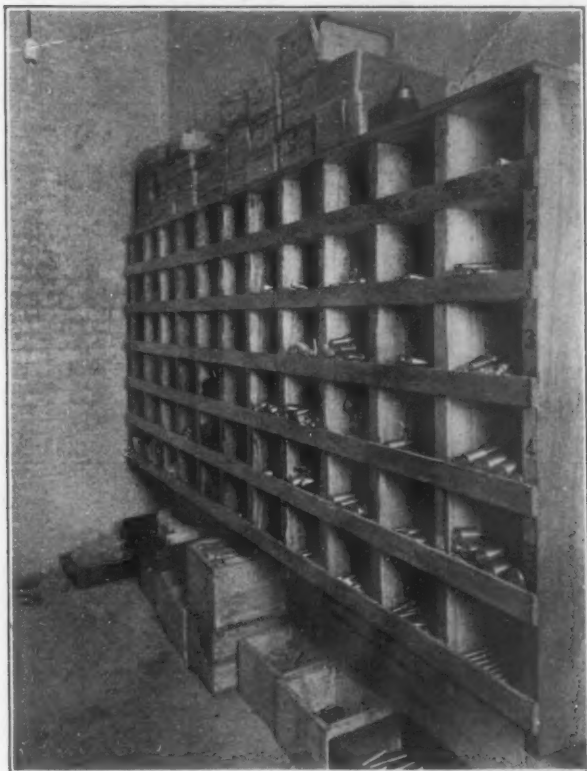
ing together of machinery rather than by the building of new plants and additions. The equipment in this room, particularly the milling and shaping machines, would interest most machinists by reason of the many developments in jigs, fixtures and special attachments. The simplification by these special developments of what would otherwise be slow, expensive and intricate machining operations, has been no small factor in the growth of the plant and the popularity of the product. Occupying the space between the stairways at one end of this floor is a well-arranged toolroom with some of the heavier tool making equipment located in an adjoining corner of the machine shop.

From the third floor the finished parts are carried to the second floor where they are delivered direct to the assembling department or, as is more frequently the case, turned into the finished parts

tends the length of one side of the room. Unusual care and skill are necessary on the part of the assemblers, as the slightest deviation of the chuck jaws will cause the drill to "run out" from the axis of rotation of the drill spindle. The final tests are calculated to detect any such error.

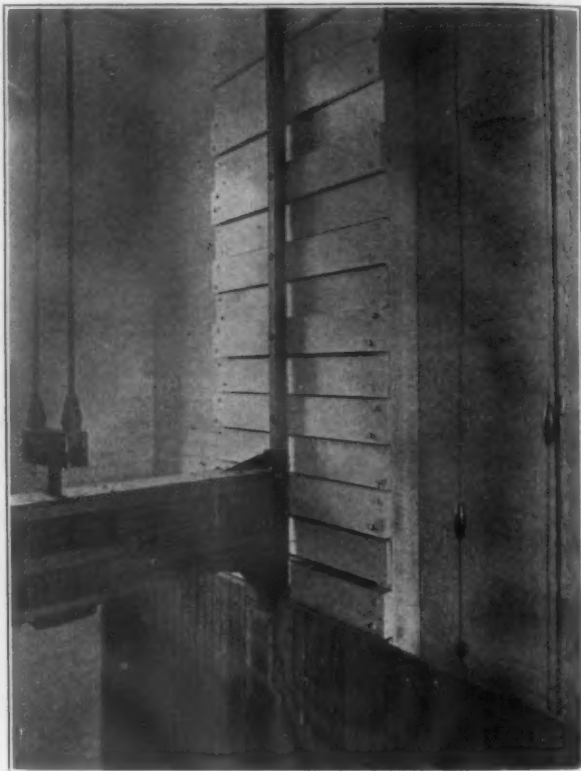
One end of this floor is used as an office and a file room, the latter being a brick walled room which is practically a fireproof vault. A large section of this floor is partitioned off to provide a recreation room for the employees who do not leave the factory for lunch. This is provided with reading matter and smoking is permitted outside of working hours.

There is sufficient land for future expansion and the location of the elevator, boiler room and employees' stairway will permit the erection of a large addition on the Rowe Avenue side without changing the structural features of the present building and



One of the Fireproof Vaults for Storing Finished Chucks, Parts, Jigs and Fixtures, All the Parts for One Size of Chuck Being in a Horizontal Tier and the Similar Parts for Each of the Six Standard Sizes Being in a Vertical Tier

bins which, as previously stated, are placed in the fireproof vault on this floor. The arrangement of these bins is shown in an illustration. As there are six sizes of chucks made for regular stock, the bins are arranged with all the parts for one size of chuck in a horizontal tier and the different sizes of each specific part in vertical tiers, making the selection of a particular part of any size chuck an easy matter. A large storage rack for finished chucks, also placed in the vault, has shelves with the same arrangement. The chucks are wrapped in oiled paper and inclosed in paper cartons. Storage for the empty cartons is provided by a large platform suspended from the ceiling beams in the corner formed by the elevator well and the side wall. The packing department occupies the space between the elevator and the storage vault. The packing is done on large truck tables which can be moved about to benches where the assembled chucks of different sizes are stacked. The assembling department requires a considerable equipment of tools, both hand and machine, and an assembling bench which ex-

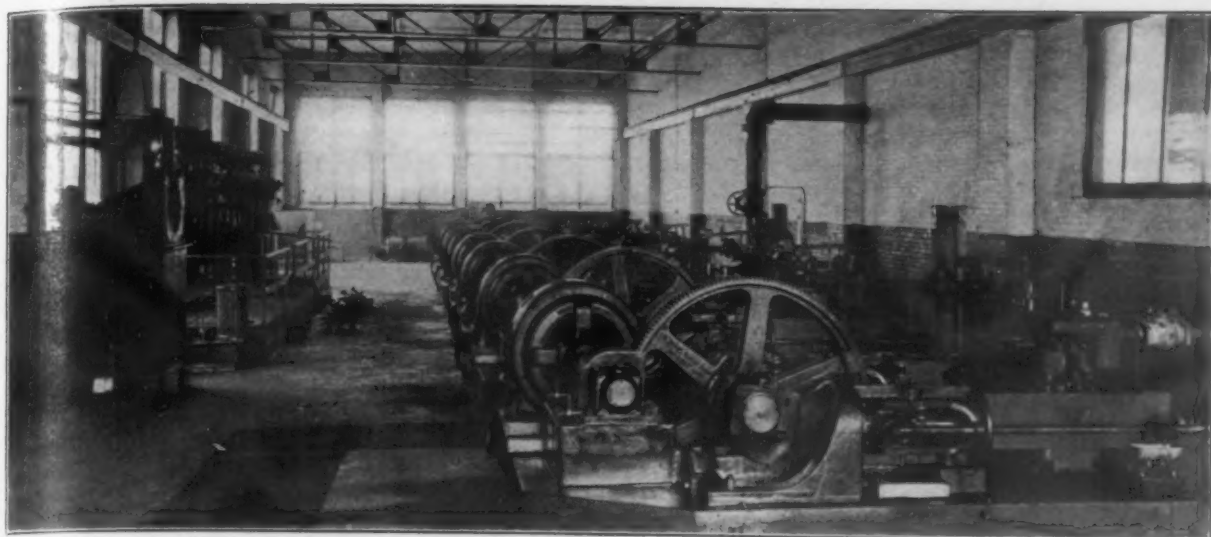


The Elevator Counterweight Is Protected by Alternate Thick and Thin Boards, the Former Being Firmly Bolted to the Guides, While the Latter Are Fastened by Two Nails at Each End Having the Heads Projecting for Easy Removal

without addition to the elevator and boiler equipment. A five-car brick garage has been built in the space which will constitute the court of the factory when expansion becomes necessary.

The present officers of the company are Arthur I. Jacobs, president; Louis E. Stoner, treasurer, and Raymond B. Jacobs, secretary.

The Department of Ceramic Engineering of the University of Illinois, Urbana, Ill., will mark the beginning of a new college year in September by offering unusual facilities to those interested in the clay-working industries. Ceramic engineering, broadly defined, covers the science and practice of cement mills, of tile factories and brick yards, of terra cotta mills, of porcelain factories, including those making tableware and electrical insulating materials, and of glass works. The field is broad and rapidly developing. Conditions imposed by the European war are prompting American manufacturers to extend their undertakings and have created an unprecedented demand for men who can lead and for facts that will guide. The University of Illinois has anticipated this demand.



Hydraulic System in Modern Shell Plant

Pumping Equipment and Other Notable Features in New Shop of Hydraulic Pressed Steel Company, Cleveland

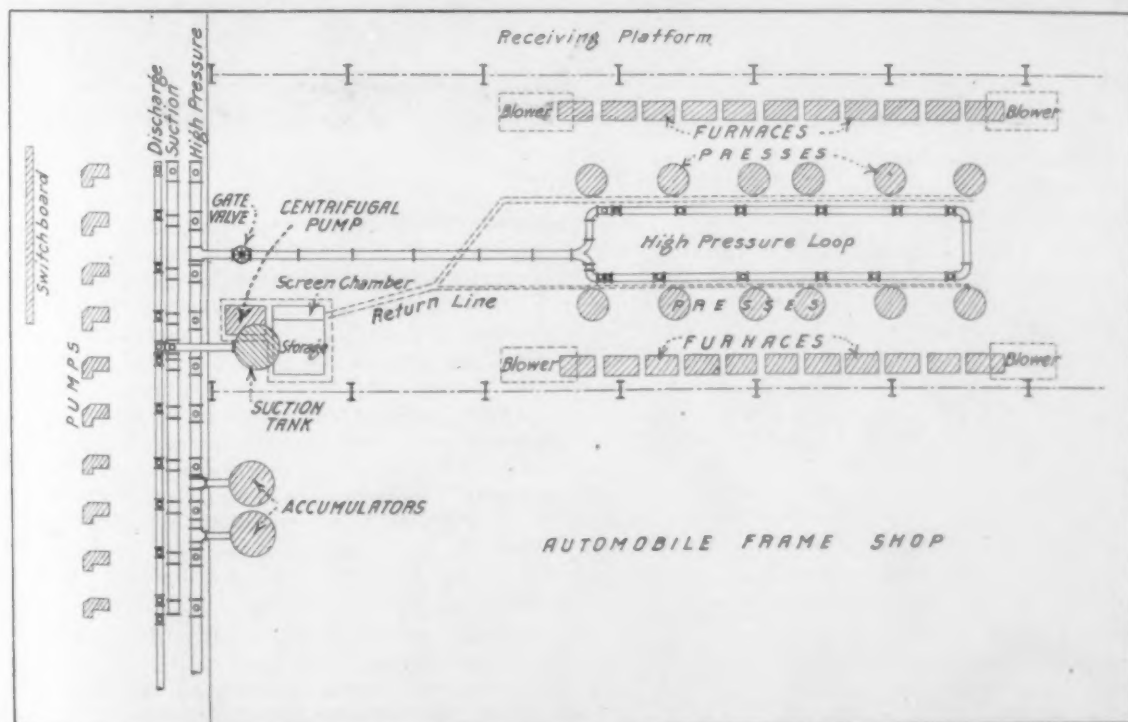
— BY F. L. PRENTISS —

THE heavy demand for shrapnel and high-explosive shells for use in the European war has made it possible for the American manufacturers taking large shell contracts to build plant extensions on a large scale. They have laid out new units according to the most advanced practice in their particular field, having opportunities to design a modern well-arranged plant that the manufacturer who is making minor additions from time to time commonly does not have. In the case of manufacturers of pressed steel using hydraulically-operated presses, as for making automobile parts and other pressed steel forms, it has been the usual practice to install an additional pump in such space

as may be found available to meet the additional requirements. There has rarely been the systematic arrangement that may be developed when an entire new plant of large capacity is being built.

THE HYDRAULIC EQUIPMENT

A notable example of a large new plant, the construction of which to a certain extent has been made possible by war orders, is that of the Hydraulic Pressed Steel Company, Cleveland, Ohio. One of the most interesting features of this plant is its hydraulic system for the hydraulic presses used in making shrapnel forgings. The shell plant is equipped with six units, each consisting of a



Plan of the Shell Piercing and Drawing Plant and Adjoining Pumping Plant

piercing and drawing press, and its capacity is indicated by the fact that its present daily output is 15,000 3-in. shrapnel forgings. In the control of the pumps and arrangement of the piping system a number of original and interesting features have been adopted to reduce the maintenance and operation cost and make the hydraulic plant practically automatic in its operation. While the shell plant is equipped for making shell forgings, it was laid out with a view of converting it to other hydraulic press work as soon as the demand for shell forgings ceases.

The plant extensions of the Hydraulic Pressed Steel Company include a shell shop 76 x 360 ft., an automobile frame shop 80 x 560 ft. and a pump house adjoining the above-mentioned buildings at one end, 40 x 157 ft. The main buildings have struc-

ture care of the entire pumping equipment. The arrangement also makes it possible to serve the entire pump house with one overhead crane for use in case of repairs. The current for driving the pump motors is supplied through a transformer station adjacent to the pump house. Electricity enters the transformer house through public service lines at 11,000 volts and is stepped down to 220 volts, alternating current. Two switchboards are provided, one in the transformer station where the electrical power for the entire battery of pumps is controlled, and another in the pump house that is provided with separate switches for controlling the individual pumps.

The headers are located in a trench between the pumps and the accumulators. The pumps discharge into a 10-in. high-pressure header, each being con-



Three of the Large Hydraulic Press Units, Each Unit Consisting of a Piercing and Drawing Press. The oil-fired furnaces appear in the background along the side wall

tural steel frames and the Pond type of roof trusses. The greater part of the side wall space is covered with wire mesh glass fitted in steel sash. The main buildings are parallel and join with no partition between, making them practically one building.

The pumping equipment consists of eight Deane of Holyoke duplex high-pressure pumps, with 4½-in. plungers and 12-in. stroke, having a capacity of 200 gal. per minute each, and maintaining a pressure of 1050 lb. per square inch on the high-pressure lines at all times. Each pump is driven by a 150-hp. direct-connected Westinghouse motor through a herringbone gear. Foundations are provided for two additional pumps that will be installed shortly for operating the presses in the automobile frame department.

The pumps are located in a row along one side of the pump house. The compact arrangement of the pumps simplifies the piping layout and the wiring for control and reduces the labor cost of operation. One attendant and two oilers are able to

nected to the header through a line containing a gate shut-off valve. The return water to the pumps is carried by a 14-in. header. A third 12-in. header, in the trench, allows the water to circulate at low pressure when a pump is not in service, thus making it unnecessary to shut down the pump motors and pumps.

The number of pumps running at any one time depends upon the amount of water required. The control of the pumps and water supply is entirely automatic. The pumps are controlled by means of an automatic valve operated by a multiple air valve which is controlled by a cable connected to the accumulators. The operation of the multiple valve is such that when the accumulators drop 1 ft. one pump is cut in, and an additional pump is cut in for every additional foot of drop of the accumulators. The reverse applies as the accumulators rise, one pump being cut out for every foot of rise.

When the pump valve, controlled by the air valve, is opened it puts the pump directly into communi-

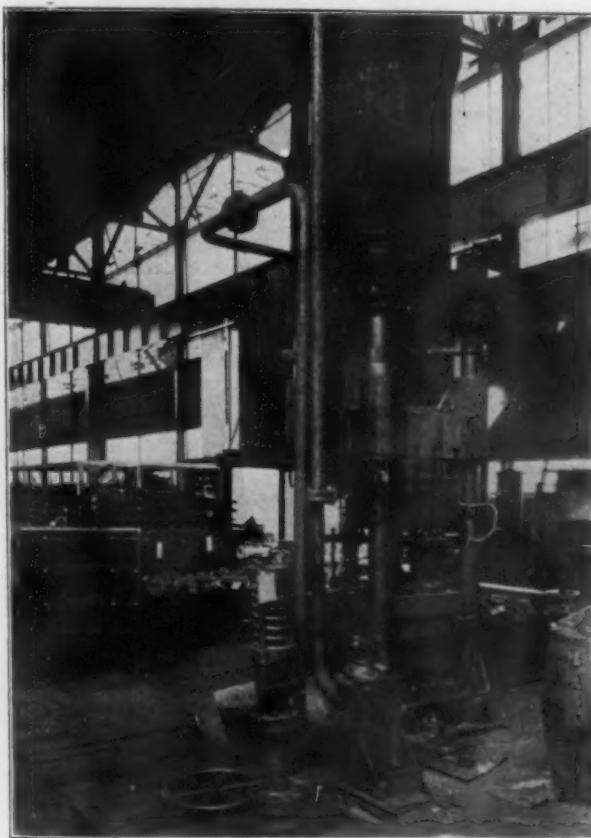
cation with the high-pressure line. When the valve is closed the water, instead of going into the high-pressure line, circulates through the low-pressure header, thus allowing the pump to operate at practically no load. The high-pressure header is connected in parallel with two accumulators of 500-gal. capacity each, 28 ft. high and 15 ft. in diameter. These, of course, serve to maintain the pressure constant, regardless of the quantity of water that is being used in the operation of the presses.

Overhead piping is eliminated by having the water supply lines run from the header through the shop in tunnels. The water is carried from the high-pressure header through a 10-in. main pressure line from which 8-in. branch lines are carried through the shop, each branch line serving three units and each unit consisting of a piercing and drawing press. One main shutoff valve is provided on the 10-in. line and there is another valve for each press with an 8-in. line. This small line is provided with a shock valve, which acts as an equalizer, and a three-way operating valve. The shock valve takes the place of the usual overflow chamber and has the advantage of taking less space than is required for the latter. Two lines are carried from the valve, one going to the main press cylinder and the other to the pull-back.

The trench back of the pumps, in which the main lines are located, is of concrete, 6 ft. 3 in. deep and 4 ft. wide. The branch tunnels in the shop, also of concrete, are 4 ft. 6 in. x 3 ft. 9 in., and the loop tunnel connecting the branches is 3 ft. 4 in. x 3 ft. 3 in. In addition to the high-pressure line, they carry compressed-air lines and low-pressure city water for cooling. The return lines consist of 4-in. laterals opening on 10-in. lines that lead into 12-in. mains on each side of the shop. These return pipes are buried under the shop floor.

The 12-in. return line leads through screen chambers into an underground concrete tank of 5000 gal. capacity. From this tank the water is pumped by a 10-in. centrifugal pump located adjoining the tank beneath the shop floor to an elevated suction tank 8 ft. in diameter and 12½ ft. high, connected to the return header. This pump is controlled by a float switch. The suction tank takes the place of the usual overhead tank, and its use eliminates overhead pipes with screw or flange joints, with their large cost of maintenance. The suction tank provides a maximum head of 8 ft. on the pump valves. The water is drawn from the suction tank by the pumps, and if any part of the suction tank system is out of order the water can be pumped directly from the underground tank.

Double extra heavy steel pipe of ¾ in. wall thickness is used for high-pressure service lines. The return lines are cast iron. All supply lines of every kind are arranged in loops so that each unit can be isolated. Provision has been made for outlets to a water cooling system, providing it is found desirable to install such, but so far this has not been found necessary, as the maximum temperature of the water is 130 deg. Fahr. with a maximum shop temperature of 96 deg. In the equipment of the entire plant two additional accumulators, one of 150 gal. and the other of 300 gal. capacity, will be moved to the new buildings from the old plant. An equalizing device is being provided to insure the equal travel of all accumulators, giving a high-pressure water capacity of 1500 gal. per minute. The maximum intensified pressure used in the plant is 6000 lb. per square foot.



Close View of One of the Presses, Showing the Shut-Off Valve for the Press, Shock Valve, Three-Way Operating Valve, In-Going High-Pressure Line to the Presses and the Return Line. At the left of the press is one of the tool boxes with three drawers containing tools for the press gangs employed on the three turns

OPERATIONS IN FORGING SHOP

The fuel oil for the four furnaces is supplied by a pumping system consisting of one steam and two reserve electrical pumps with a total capacity of 400 gal. per minute. The oil is stored in two 6000-gal. steel underground tanks. The piercing and drawing press equipment and accumulators were furnished by the Southwark Foundry & Machine Company and the valves and fittings were supplied by the Crane Company.

Specially designed tool boxes are provided for tools used in changing the tools in the presses. These boxes are of steel 50 in. high, 40 in. wide and 19 in. deep, standing on legs and having three drawers 10 in. deep. The plant operates on three 8-hr. turns and a tool box is provided for each press, each of the foremen having separate set

of tools which he keeps under lock in one of the drawers. In this way the man in charge of the press gang is made responsible for his own tools and the trouble of having tools lost or mislaid when handled by separate sets of men is eliminated.

Economy and speed in production required convenient arrangements for the handling of material through the plant. Steel bars cut to length are unloaded on the platform on one side of the shop. Approximately 100 tons of material is converted into 15,000 shell forgings in a day of three 8-hr. turns. The blanks are thrown from the cars into steel boxes, placed on trucks, each box having a capacity of 500 blanks that weigh a trifle over 13 lb. each. The trucks with loaded boxes are pushed or pulled into the shop through a side door with an electric tractor and the boxes are picked up by a

(Continued on page 261)

Mobilization of Industrial Resources

Experiences and Observations of A. L. Humphrey, of the Westinghouse Air Brake Company, in the Manufacture of War Munitions

WHAT the making of war munitions for Europe and the securing of materials therefor has taught American manufacturers was told by A. L. Humphrey, vice-president and general manager of the Westinghouse Air Brake Company, Wilmerding, Pa., before a meeting held under the auspices of the Engineers' Society of Western Pennsylvania at the Carnegie Music Hall, Pittsburgh, on May 31. The address was the fifth and last of a series of military engineering lectures, and a copy of the address in full has just become available from advance pages of the June *Proceedings* of the society. Mr. Humphrey's attitude is

ing Board; discussed the need of this country's being self-sufficient and self-contained with regard to the sources of materials needed in war time; described briefly the manufacture and loading of timing fuses; argued for universal training, and urged the necessity of paying attention to transportation systems, which, in the time of emergency, are the connecting links between the factory and the battle front. In spite of the exactions of the specifications and of the final tests for acceptance, Mr. Humphrey mentioned that his company at the time of his address had almost completed a contract for 1,250,000 shrapnel shells and not a single lot

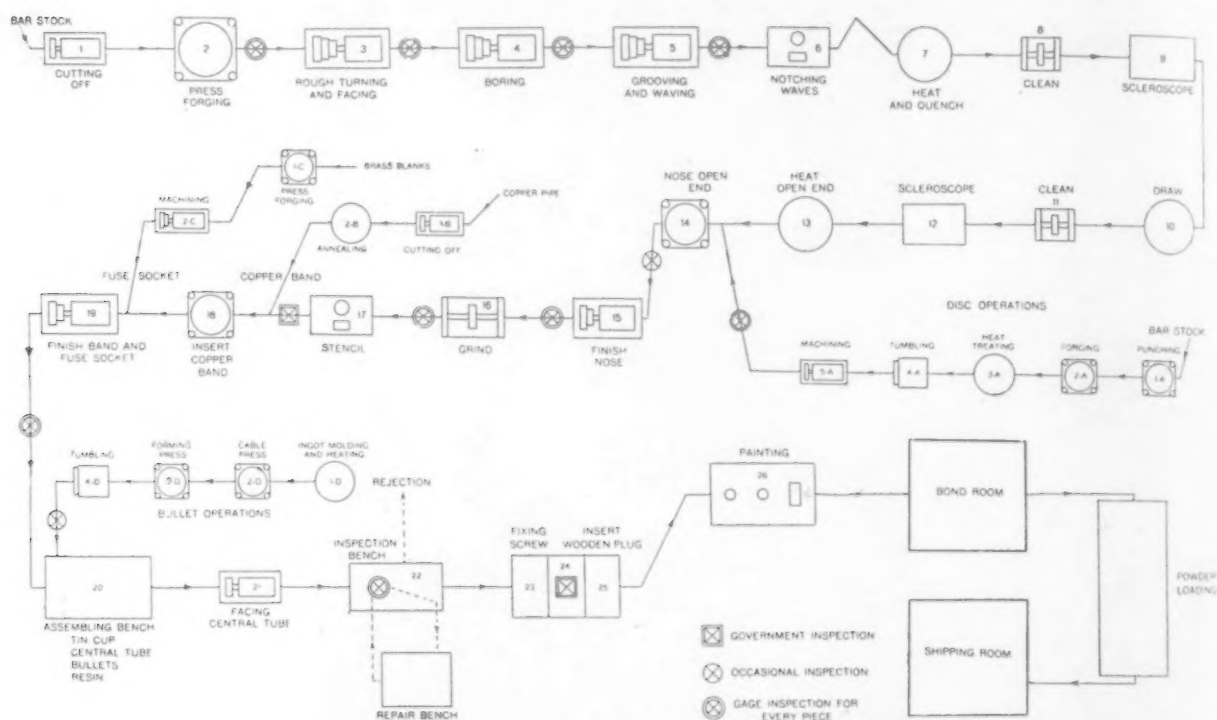


Diagram of Operations and Shop Routing for Manufacturing Shrapnel Shells

that manufacturers engaged like his own concern can render a great national service by imparting the information gained in their own experiences to managers of other plants which are likely to be enrolled in a general preparedness scheme in any war in which this country may become involved.

Among the topics which he discussed at length was the preparation which must be considered by any company which takes on war business without building or equipment or organization and also by the concern which starts with a sufficiently large organization from which a nucleus can be taken for handling munitions work. He emphasized the need in time of war of keeping men at home who are skilled and specially trained for the work of munitions manufacture. He had something to say about restrictive labor legislation in checking output and preventing men being paid according to their ability, and he told of the satisfactory performance of women in machine shops in this country. Naturally he made some convincing observations on unnecessarily exacting specifications, and the question of gages, jigs and special fixtures received extended consideration. On the general matter of preparedness, he outlined the notoriously weak situation in this country; dwelt on the dangerous concentration of manufacture along the Atlantic sea coast; told something of the work of the industrial preparedness committee of the Naval Consult-

had been rejected and in only two cases were shells required for a second proof to check the first.

With regard to the secretiveness of some manufacturers at the time when others were organizing for the task of making ammunition, he asserted that such could have supplied valuable assistance without monetary loss or violation of any business ethics. The volume of European orders at that time, he explained, exceeded the capacity of the available manufacturing plants, yet the manufacturers in question absolutely refused to divulge any helpful information, even though one may have been a customer of the other along ordinary commercial lines, and the mutual relationship had been most cordial. "It is needless to say," he continued, "that this narrow-minded and selfish attitude cost enormous sums of money and much valuable time. Contrast this attitude with that maintained by our brother manufacturers in the Dominion of Canada. The ammunition plants there threw their doors wide open, and those United States manufacturers who sought information not only had their requests gratified, but knowledge was gladly and liberally imparted in every instance."

With privately-owned plants delivering, under the plan of the Industrial Preparedness Committee of the Naval Consulting Board, a small, constant output to the Government, the arsenals of the latter, he suggests, could be used for testing and general development work

and for building the secret devices arising from such work. This plan would much reduce the overhead charges as compared with a Government plant of the maximum capacity necessary, forced to run at a load of perhaps but 10 per cent. As an example, the overhead charges for the production of armor plate by the Bethlehem Steel Company are carried in the greater measure by the mills and furnaces devoted to the standard steel product, and the Government therefore could not begin to produce armor plate at the costs possible in the private plant—quite aside from all considerations of "pork" and political inefficiency.

The address in part was as follows:

EQUIPPING FOR MUNITIONS MAKING

Most of the contracts with foreign nations were taken by combinations of manufacturing interests. The combination with which I happen to be associated consists of three extensive companies with well-organized manufacturing plants located in four geographic centers of the country: The American Locomotive Company, with plants at Dunkirk, N. Y., and Richmond, Va.; the New York Air Brake Company, Watertown, N. Y., and

\$25,000,000 to \$28,000,000 before one cent of profit was received. This enormous expenditure will indicate the serious responsibility that the officers of the different companies took upon themselves for the purpose of providing employment for their idle workmen and incidentally to put a little profit, perhaps, in the pockets of the stockholders of their companies.

The plant for making munitions may be considered from two viewpoints: The new concern without buildings, equipment or organization; and the going concern.

In the case of an entirely new plant, careful consideration must be given to the following points:

(a) A preparatory schedule on the basis that the contract is sufficiently large to warrant installation of the most suitable types of tools for the work.

(b) Plan of buildings most suitable.

(c) Organization.

(d) Labor costs.

The condition of the machinery market and the urgency of the contract will largely determine the type of machine installed. In every case, where possible, automatic or semi-automatic machines should be given preference, in order to eliminate the necessity for any

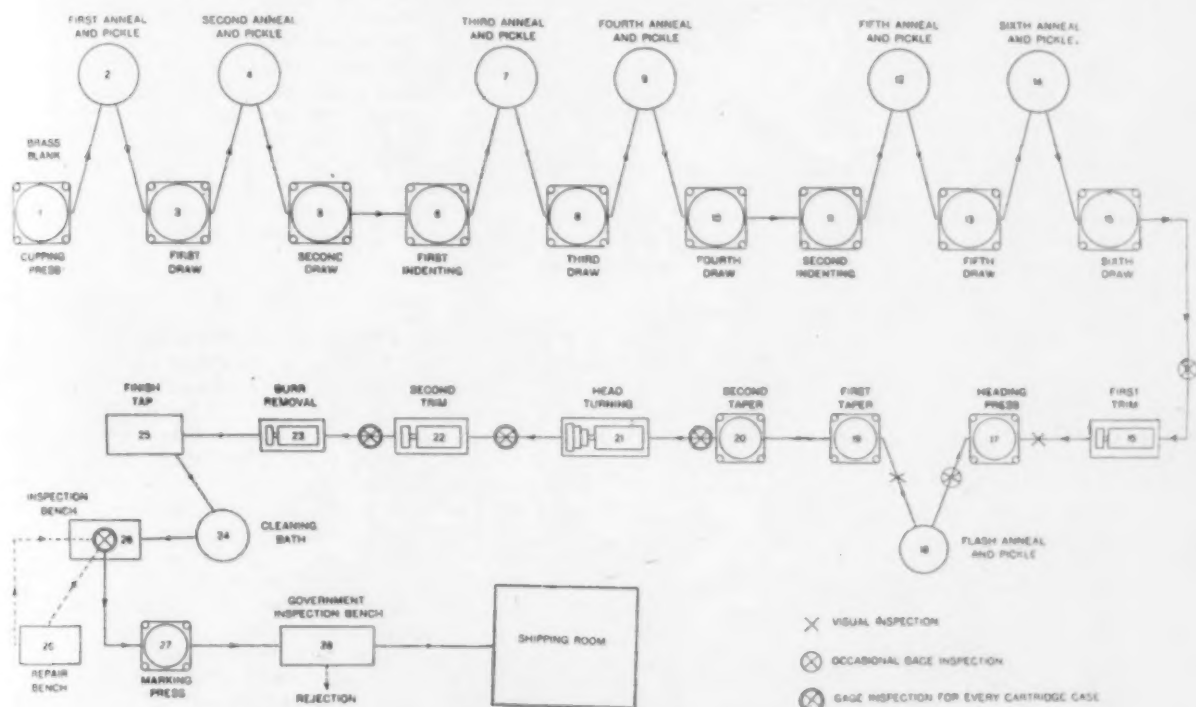


Diagram of Operations and Shop Routing for Making Shrapnel Cartridge Cases

the Westinghouse Air Brake Company, Wilmerding, Pa. One contract called for 5,000,000 shells, all for one country, 2,500,000 being for shrapnel shells and the remainder for high explosive shells. In addition, contracts for small amounts were taken from some of the other countries at war.

After the contract was executed, new buildings were constructed, materials, machinery and supplies of all kinds were contracted for and the actual work of manufacturing begun. Not one of the three companies referred to was able to obtain, with but one exception, a single expert or employee who had ever worked in an ammunition factory of any description.

The machinery required for the economical manufacture of the projectiles was designed, manufactured, and installed, irrespective of the large bonuses and enormous prices demanded. The work was undertaken with vigor and determination to meet the guaranteed date of delivery. The company with which I am directly associated was compelled to spend between \$6,000,000 and \$7,000,000 in constructing buildings, providing machinery, manufacturing jigs, gages, patterns and special appliances and for the purchase of materials before one single payment had been made by the foreign governments. Assuming that the other companies forming our combination made corresponding expenditures, the total amount paid out in getting ready for the work was

degree of skill on the part of the operators, and thereby reduce materially the losses due to error of the individual. Careful consideration should be given to every detail of the manufacture before decisions are made as to the types of machines, a thorough time study made and the most logical sequence of operations worked up and scheduled. Too great stress cannot be placed upon this feature, as any changes it may be necessary to make after machines have been ordered will result either in considerable loss or inefficient manufacture. Grouping of the machines should also be gone into very carefully to avoid unnecessary handling and permit the product to travel from one operation to another with the least amount of labor.

With the above data settled, the size and type of buildings required can be quite readily determined. As a concrete example I might state that a building 65 x 600 ft. of wooden construction, concrete foundations and sills, with a capacity of 20,000 3½ x 11½ in. cartridge cases per day of 20 hr. equipped with necessary machines, and an additional building 65 x 150 ft. for annealing and pickling, were erected and ready for operation in about eleven weeks.

If possible, someone who has had direct experience in the manufacture of the munitions under consideration should be placed in charge, but in case such a man is not available, one with extensive experience in duplicate

manufacture and with sufficient knowledge and practical experience to keep in mind the human equation, as well as the technical problems to be met, should be considered.

Before starting manufacture to any extent, a careful time study should be made of each operation in detail, determining the number of strokes per minute of the machines, cutting speeds, best type of cutting tools, taps, etc., and the approximate piecework prices at which the work can be done, based on a certain earning per hour.

Where an attempt is made to take a going concern and convert it into an ammunition factory, it will be found necessary in practically every case to discard at least 50 per cent of the tools used in ordinary commercial work, providing the order is large enough to warrant installation of the most suitable machines. In our own case the percentage of tools suitable for this work in any one department did not amount to possibly more than 2 per cent. Assuming that in no instance would orders be considered for less than 200,000 of any one size shell, it would be a more economical proposition to consider installation of machinery for the particular contract, as by getting a uniform installation sufficient reduction will be had in manufacturing cost to more than offset the initial cost of machinery, and a better product will be obtained. The purchasing of such machinery as would be flexible enough to meet manufacturing conditions on standard products should be kept well in mind.

Where this work is undertaken by a going concern the question of organization is more simplified than in a new concern, as men having suitable training for various phases of the work can be transferred from the standard departments. This is true as to the men in charge as well as to workmen, and will result in getting production started in a much shorter period than where an organization must be built up from the bottom. Under these conditions the time required to equip our plant and have production in full swing required approximately four months. In general, this will depend upon the supply of labor and the availability of the necessary machinery. A great deal will depend upon the machine tool market as to how soon a plant may be placed in full operation.

RESTRICTIVE LABOR LEGISLATION

It has been estimated that for every man needed at the front to operate the machines of actual warfare



Because One Radius for the Arc of Stenciled Lettering was 1/32 In. Longer than the Other, 7000 Cases Were Rejected After 60,000 Had Been Accepted

there are needed three men at home to furnish him with the supplies for his operations. Thus for an army of two million men at the front six million men are needed in the work shops to keep supplied the men in active service. When one considers that there are not more than 3000 truly expert gage makers in the country,

the point where they can render most effective service is fully apparent. The work of the Committee on Industrial Preparedness, then, is most wise in listing our skilled artisans that they may not be foolishly sent to the front in the time of need and thereby impose starvation upon military operations.

Right here let me draw attention to the insidious, lurking dangers in the way of restrictive labor legislation that have become so manifest to the manufacturers of this country who undertook at an enormous financial risk the manufacture of a commodity with which they were not familiar. The absence of laws governing the hours of labor and output, together with the hearty co-operation of their employees, enabled the manufacturers mentioned to inaugurate a system for increasing production and for rewarding their employees on the basis of individual skill and efficiency. I have been informed by the representatives of foreign governments that the excellent results obtained from this system have amazed the world.

I want to go on record as saying that had the manufacturers of the United States been compelled to quote prices on ammunition contracts received from foreign governments during the past two years under the restrictions imposed by our own National Government, it would have been necessary to bid from 25 to 50 per cent higher than the prices at which the contracts were actually taken, and it is the opinion of those in a position to know that such prices would have been prohibitively high and that the business would not have been procured. Unhindered by foolish laws, mechanics engaged in the manufacture of ammunition have been able to earn from 50 to 100 per cent more than has ever been earned by the same class of workmen heretofore.

WOMEN IN THE WORKSHOP

In Europe the emancipation of woman has advanced very rapidly, due to the vast war which has called the men to the front and has left much of the work at home to be done by women. In our country also the sphere of woman's activity has widened recently, and this is of great significance in our problem of training and mobilizing skilled labor. As a concrete illustration I wish to refer to the Recording & Computing Machines Company, Dayton, Ohio, which took the contract for the manufacture of five million time fuses for the Russian Government. This work was undertaken by an organization entirely inadequate for the project. As time went on they found it impossible to obtain not only experts, but male help in general. Like the combination that I have referred to and with which I am associated, Mr. Ohmer, president of the Dayton concern, decided, on account of the impossibility of obtaining skilled assistance in carrying on the new line of work, and not being able to obtain male workmen in sufficient numbers, to employ female help quite generally throughout the entire plant.

After a personal investigation of the successes at present being attained at Mr. Ohmer's factory, I am glad to record the fact that his company is now employing approximately 6000 people and is manufacturing 20,000 to 30,000 time fuses per day. These fuses are meeting the specifications in every particular and 80 per cent of the work is being done by women gathered together from Dayton and vicinity. These women are employed in every class of labor, with the exception of that requiring more physical strength than they can muster. Between 3000 and 4000 of them are running screw machines, drills, mills, lathes and many of them have learned in a short period of time how to grind their own tools. They are not only doing men's work, but a study of the time sheets shows that many of them, who are working entirely on piece work, are doing with ease quite a good deal more work than the men whom they displaced. It is gratifying to say that the women mentioned are being paid according to their efforts, many of them earning as high as \$5 to \$6 a day. To quote Mr. Ohmer, the company "makes no discrimination in the pay as to whether it be for man or woman. Since the time women have been put in the places of men assigned to other duties, the product has multiplied by leaps and bounds."

THE MATTER OF SPECIFICATIONS

Military supplies should, so far as practicable, conform to standards established by experts having a full comprehension of all the factors involved in the way of ballistics and commercial manufacturing as well. The plans and specifications of these materials should be submitted not only to the scrutiny of manufacturers, but also to that of the consulting or advisory boards. They will thus be able to point out many modifications

tion. After some months of negotiations and delay, the foreign government was notified that the magnesium powder could not be obtained and that in order to fill the contract it would be necessary to eliminate this item from the specifications, which was finally done, thus making the specifications similar to those of other European countries.

In our negotiations we found certain compositions of brass desirable for the manufacture of the timing fuse. Perhaps it will be found that the abnormal demand for large quantities of a certain grade of copper and spelter would make it difficult to obtain the required amount, or at least the price might be so high as to prevent the manufacturer from making a reasonable bid. In this case, is it not possible that some other alloy could be used? From experience in the manufacture of our standard line of apparatus we are firmly convinced that the metallurgist and the chemist can work out problems of this sort.

A very important factor which enters into this question is the workability and the machining properties of a given material. In the specifications provided by some of the foreign governments we have found that, while the material specified was ideal, so far as tensile strength, ductility and other properties were concerned, it would be so difficult to machine that the labor expended would often be three or four times the amount that would have been necessary had the specifications been prepared with this most important item in view, as well as supplying the necessary physical properties.

GAGES, JIGS, SPECIAL TOOLS

One of the most crying needs in the recent mobilization of American industrial talent in the service of foreign governments has been for gages, jigs, machine fixtures and other special tools. In the manufacture of the combination time and percussion fuse, 170 gages are required to make a complete set, and we are using seven sets for an output of 10,000 fuses per day of 20 hr., or a total of 1190

gages. A total of 243 separate operations are required to complete the details and 32 special fixtures and jigs.

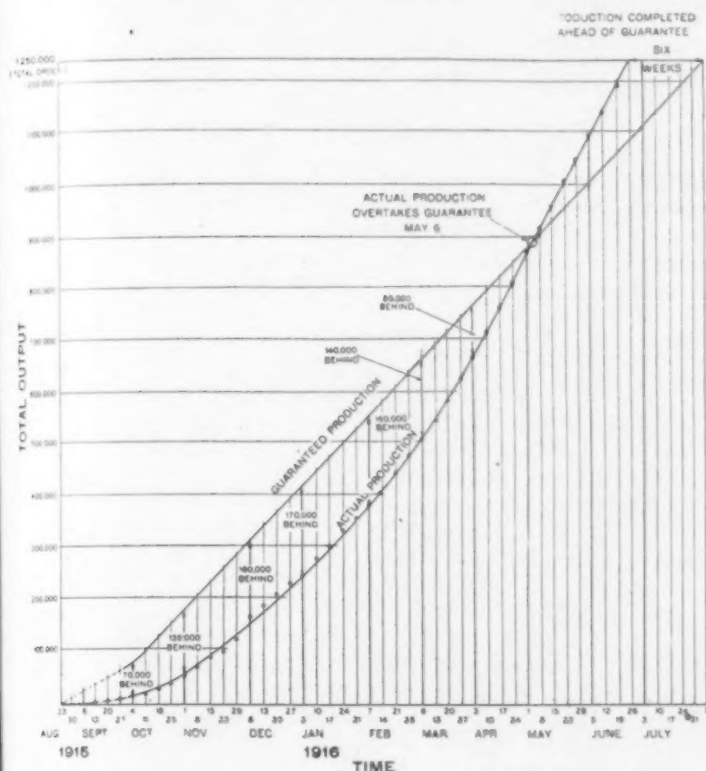
On the shrapnel shell and details a total of 128 manufacturing operations are required and 51 shop inspections. There are 65 gages used, five sets being required for an output of 10,000 shells per day, or a total of 325 gages.

In the manufacture of the cartridge case there are 50 manufacturing operations and 15 inspections. Seventeen gages are required for one set, and approximately five sets are in use for an output of 10,000 per day, or a total of 85 gages.

It might be said that even to-day, after one year on this work, gages, fixtures and tools are constantly being subject to revision and simplification. These are matters which require time to develop and a national emergency should not be awaited before applying the necessary attention.

None of the European governments was able to furnish master gages. All gages and special tools that were prepared by the American manufacturers had to be made from drawings and specifications. The permissible tolerances were small and in many cases the exact type of gage required was exceedingly indefinite. Lack of time will prevent my speaking in any but general terms, but from information that I obtained during close observations and constant association with the work, I believe I can say without hesitancy that the greatest problem the munition manufacturer had to overcome was the obtaining of the jigs, gages, special tools, etc.

Therefore, profiting by the experience obtained by the manufacturers in their present undertakings along the ammunition line, the Government should manufacture a supply of jigs, fixtures, gages, cutters and special tools far beyond any possible expectation of requirements; doing this after the designs have been agreed upon jointly by the consulting board, the manufacturers.



The Total Production of a 1,250,000 Shell Order, Week by Week, Compared with the Guaranteed Production

which would reduce the manufacturing cost and thereby speed up the output without materially affecting the military value of the product in the way of service on the firing line.

As an illustration of requirements utterly unreasonable I may, for the benefit of our own Government, speak of the rejection of 7000 cartridge cases for a defect in stenciling which happened at a local plant. The specifications called for the formation, by the stenciled letters, of a true circle concentric with the cartridge case head. Due to one of the tools becoming slightly sprung the radius to one end of the stenciling exceeded the radius to the other end by about 1/32 in. Sixty thousand cases had already been accepted and shipped before this was discovered. Seven thousand finished cases awaiting shipment were rejected on this account alone. Though the specifications provided no latitude, the poor judgment was almost wholly that of the inspector in view of the opening left by the Government. As a rule, however, the Government inspectors with whom we have dealt, that is, the British—have been thorough and business-like, and to their co-operation and assistance is due much of the success of our undertaking.

From our own experience, when going over the specifications offered by various countries, we have picked up weak points which show that the factor of quantity of available material was not considered. For example, in addition to the question of antimony, which it might be impossible to obtain if we were at war with the country from which it is now being secured, there was a certain specification from one of the Allies that provided for a quantity of magnesium powder in the manufacture of shrapnel. It was found upon investigation that there was in the United States not more than one-fourth the magnesium powder required to supply the demand called for in this particular specifica-

and the Government officials. Gages are to be used only for from 8000 to 10,000 gagings and then scrapped. The surfaces become so abraded that the gage is no longer sufficiently accurate for the work and new gages

must be substituted. Thus it will be seen that in plants where rifles, shrapnel and high explosive shells are being manufactured to the extent of from 5000 to 20,000 per day, the number of gages required is enormous.

Machining 9.2-In. High-Explosive Shells

Details of Each Machine Operation
Described in Sequence with Data on Time
Consumed as Determined by Stop Watch

—BY G. F. BRYANT—

THE method of machining outlined in the following article is based on the actual performance of several of the leading manufacturers of both the United States and Canada, and the production figures contained herein are the result of the writer's personal observation. At the beginning of the European conflict, the writer's efforts were directed exclusively to the design and manufacture of complete equipment, comprising jigs, fixtures, cutters and machine tools, for the machining of a large variety of shells, and the following is an accurate survey of the situation after many of the manufacturers have been producing shells for a period of one year.

The first demand made on the various engineers was for equipment necessary to the making of small sizes of shells. This was, of course, a comparatively easy task, as the smaller sizes of shells were readily adaptable to the equipment of plants engaged in what might be termed medium heavy work, and as there were many of such plants available, it was a comparatively easy matter for such manufacturers to employ their equipment in the machining of these smaller shells. As time elapsed the demand for small sizes of shells greatly diminished and the engineers of the country were confronted with quite a different problem in machining shells in 6-in. and larger sizes, as there were few manufacturers who possessed such equipment as could be readily adapted to their manufacture.

THE ROUGHING OPERATIONS

The first machining operation of the 9.2-in. shells is to drill and ream a preliminary hole in the nose end concentric with the true axis of the curved portion of the shell, which is used later for trueing up the inside of the rough shell for the operation of boring (see fifth operation). The shell is placed in a drilling jig, Fig. 1, and stands in a vertical position, having an aligning mandrel which acts as a guide at both the nose and base ends of the shell. A three-jaw universal chuck device is arranged at the base of the mandrel and clamps the shell in a central position with the holding mandrel, which is in true alignment with the drill guide hole. The outer nose end is faced after the hole is drilled and reamed, on the same fixture, by unclamping the guide which is pivoted at the top of the fixture and lifting it out of the way. The end is faced to a specified relation to the inside of the nose, leaving a uniform amount of metal for boring. The fixture is designed for use on a radial drilling machine, and requires an operator and helper. By means of a suitable hoist the helper places the shells in position in the jigs ready for drilling and removes finished shells from the opposite side of the fixture. It is common practice for one helper to place and remove shells on two machines, and with an equipment of this kind it will

be noted that the machine is in almost constant operation. The average time for this operation is $6\frac{1}{2}$ min.

The second operation consists in trimming the base or open end. At this stage the nose end has been faced and the shell is placed in a cutting-off machine having two tools, one on the front and one inverted at the rear of the machine. The shell is now cut to a preliminary length, gaging from the finished face of the nose end. The average time for this operation is 7 min. The shell is then placed in a former lathe, having an adjustable three-cutter boring head, Fig. 2, attached to the face plate. A center bearing, Fig. 3, is inserted in the nose end. The shell is then rough turned, true with the rough interior, leaving approximately 0.040 in. for finish. The average time for this operation is 35 min. It is surprisingly significant that the Canadian manufacturers, by using patented cutting tools which are supplied from the United States, are performing this and other operations in approximately 35 per cent less time than is required by concerns in the United States.

The fourth operation comprises the finishing of the inside, except the nose hole. The shell is placed in a pot chuck, Fig. 4, with the nose end supported by a straight cylindrical center which is placed in the spindle of the machine. The open or base end is gripped by a universal contraction chuck. The hole is first rough bored, including the radius, using a special boring head. The open end is then faced true and the counterbored portion roughed, after which the shell is finish bored, using the same boring head as in the roughing operation, excepting that the head is provided with finishing blades. The average time for this operation is 23 min.

At this stage of the process there hinges a very critical point, and the correct method to adopt is really so simple that many manufacturers have experienced considerable difficulty as the result of assuming the matter to be of minor importance. At the beginning of the fifth operation we now have a shell rough turned, finish bored and with a preliminary hole in the nose end. The equipment such as heretofore described and used in performing the operations of boring will permit errors to ensue between the longitudinal axis of the nose hole and that of the main bore, which if not corrected at this stage will cause difficulties with all other operations. The shell is placed on a revolving double fixture, Fig. 5, and resting on the inside curved portion of the nose finds its position concentric between the finished inside and the long guide hole in the end of the vertical mandrel. A boring bar having a double-end cutter and driven by a flexible shaft is then placed in the guide hole and the nose hole is again bored true to the longitudinal axis of the main bore, after which the hole is again reamed and used for the finish turning operation. By this method the

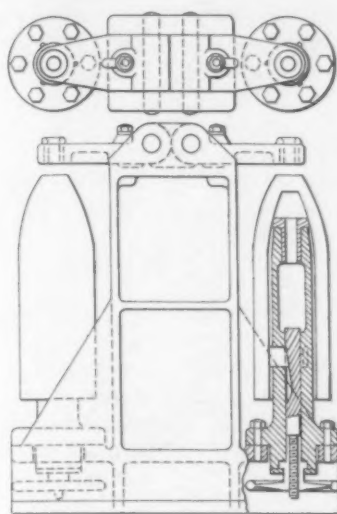


FIG. 1 - RADIAL DRILL FIXTURE PROVIDED FOR THE DRILLING OF THE HOLE IN THE NOSE END OF LARGE, HIGH EXPLOSIVE SHELLS.

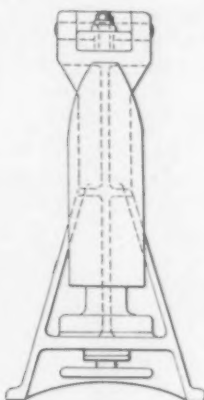


FIG. 2 - AN ADJUSTABLE THREE-CUTTER BORING HEAD FOR ROUGHING AND FINISHING THE INSIDE OF SHELL

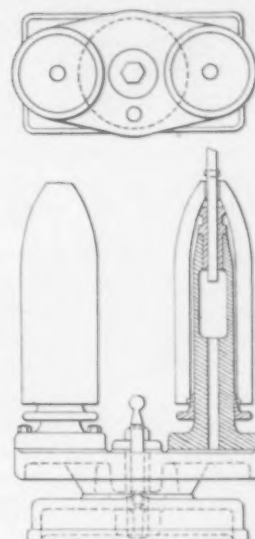


FIG. 5 - REVOLVING DOUBLE FIXTURE ARRANGED FOR MOUNTING THE SHELL FOR THE FINISHING AND REAMING OF THE NOSE HOLE

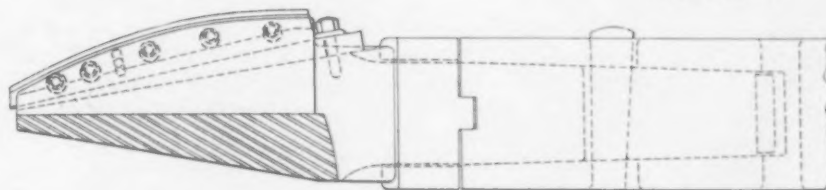
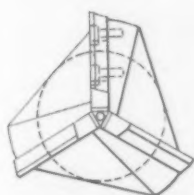


FIG. 3 - THE FORM OF CENTER BEARING INSERTED IN THE NOSE END OF THE SHELL AS A SUPPORT DURING THE OPERATION OF ROUGH TURNING

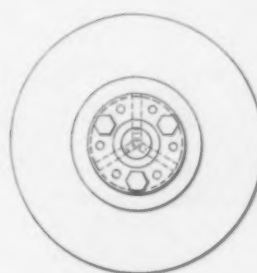
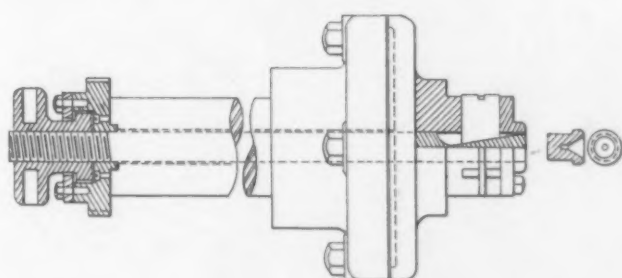
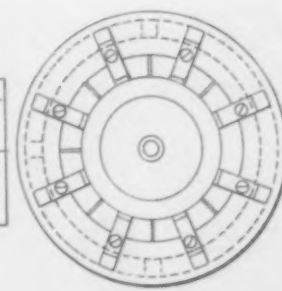
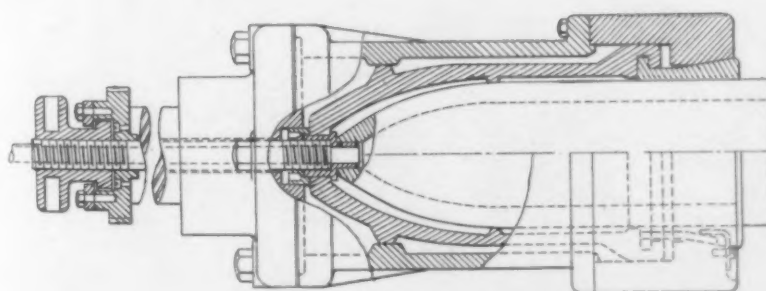


FIG. 4 - CROSS-SECTIONAL VIEW OF POT CHUCK IN WHICH THE SHELL IS PLACED FOR THE FINISHING OF THE INSIDE



Some of the Fixtures Employed in Machining 9.2-In. High-Explosive Shells

accuracy of the shell is not dependent on the stiffness of the boring bar or other discrepancies that go to make up eccentricity between the bore and outside of the shell.

The fixture is made with two mandrels to permit the changing of shells in the least possible time, the operator making the change on one side while the shell is being bored on the other. The average time required is 3 min. and an ordinary vertical drilling machine is used.

The shell is next finish turned on the outside except for the band groove, which is turned later. The open or base end is held on an expansion chuck which is attached to the face plate, and the nose end is supported on the tailstock center by a bearing inserted in the small hole in the nose. The machine used is a former lathe and the entire contour is now finished to proper size and the metal is generally removed in one cut. The average time taken is 22 min., which includes placing and removing from the machine.

The next operation comprises the roughing and finishing of the band groove. The open or base end is held on an expanding mandrel which is attached to the face plate, or otherwise arranged with the nose end supported either on the center or rest. The machine used is a lathe having a carriage arranged with a revolving tool block on the front and a waving device, engaging a cam on the face plate, on the rear of carriage. The machine runs in either direction and is reversed for the waving operation. The revolving tool block carries three tools and first necks the groove; second, removes the surplus metal with a diamond point tool by traversing the carriage, and, third, forms and undercuts, which finishes the groove. The tool block is then drawn out of the way. The machine is now reversed and the waving device brought into operation as described. The average time consumed is 17 min. Many firms are using two separate machines to perform this operation, but time may be saved by the use of one machine operating in both directions.

The copper band is now put on the shell, using a hydraulic press having a series of cylinders inclosed in a steel ring and operating on all sides of the band. The shell is placed in a vertical position in the machine. The band is heated to the proper temperature, preferably by an electric heater especially arranged for the purpose, and is then placed over the shell. Pressure is now applied and the band forced into place. The average time is 3½ min.

The counterbore at the base end is now finished and the hole directly under the band is gone over again, removing any metal that has been compressed in the banding operation and also facing the extreme end. The shell is supported in the nose hole at one end and on the outside of the body at the other end by a contraction chuck supported in the rest. An average of 11 min. is the time consumed. The machine used is a lathe having a carriage provided with revolving tool block.

THE FINISHING OPERATIONS

The nose hole is next finished, as the eleventh thread in the base end is milled, being finished by revolving the shell only once. This, the tenth operation, requires an average of 18 min., a thread milling machine being used.

The shell is placed in a contraction chuck and the operation, on a lathe having its carriage arranged with a turret and without a tailstock. The hole is tapped and the end is faced, 11 min. being the average time consumed. Operation 12 consists in drilling and tapping the fixing screw hole on a vertical drilling machine and the average time is

6½ min. In the next operation, after weighing and assembling the base plug, the band is turned on a lathe having a carriage with a revolving tool block and special slide for undercutting. The surplus metal is first removed and the band formed by the tools in the block. The fine serrations are made by a circular tool mounted on a slide at the rear of machine. The average time consumed is 10 min. The shell is then weighed again, the base plug having been removed and the shell cleaned. The base plug is now cemented, assembled and riveted, the entire operation requiring an average time of 10 min.

The fifteenth operation comprises the finishing off of the base end after the seam has been riveted together, and the average time required is 7½ min. An engine lathe having a contraction chuck and a supporting rest is used. The inside of the shell is then varnished by spraying through the nose hole and after cleaning, burring and marking is ready for the final inspection.

The base plugs are machined in accordance with the following sequence of four operations and in an average total time of 76 min.

The base plug is first held in a suitable chuck attached to the spindle of an engine lathe and the large or flange end turned to size, for which the average time consumption is 27 min. The plug is now held in a universal contraction chuck by the flange end and the threaded end is faced and turned to size, requiring an additional 29 min. An engine lathe arranged with a revolving tool block carriage is used. The thread is next milled on a thread milling machine, consuming 18 min., and the fourth and final operation comprises drilling the wrench holes. On an ordinary vertical drilling machine with a double-drill attachment the average time required is 2 min.

The average machining time consumed for the complete shell, as detailed above, operation by operation, is as follows:

Body		Base Plugs	
Operation	Time, min.	Operation	Time, min.
1	6½		
2	7		
3	35		
4	23	1	27
5	3	2	29
6	22	3	18
7	17	4	2
8	3½		
9	11		
10	18	Total time for	
11	11	plugs	76
12	6½	Total time for	
13	10	bodies	191
14	10		
15	7½	Complete job ...	267
		Or 4 hr. 27 min.	
Total time		191	

Alcohol-Benzol for Automobile Fuel

A mixture of alcohol and benzol, as a substitute for gasoline as fuel for automobiles, is a new development in Germany. From a French source the following details are derived:

Because of the scarcity of gasoline, the German Government instructed the technical department of the transportation service to seek a combustible that would effectively replace gasoline. A Mercedes 1914 touring car, having an ordinary carburetor, was used in the experiments with the following results:

Fuel	Speed per Hour (Miles)	Distance Covered on 1 Pint of Fuel (Miles)
Alcohol-benzol mixture:		
1 part benzol, 1 part alcohol.....	42	4.66
1 part benzol, 2 parts alcohol.....	41	4.47
1 part benzol, 3 parts alcohol.....	39	4.34
1 part benzol, 4 parts alcohol.....	38	4.16
1 part benzol, 5 parts alcohol.....	36	3.72
Benzol, pure	42	3.73
Gasoline, pure	44	3.60

Even if alcohol be figured at pre-war prices, the use of such a mixture is an economy, the report states. The drawback in starting the automobile was overcome by the use of a small supplementary reservoir of gasoline, benzine or ether, the mixture being substituted thereafter. Germany is now reported to be using this mixture extensively, distilling beets to obtain the alcohol.

Liquid Contraction in Cast Iron*

High Temperatures Yield the Greatest Tensile Strength—Their Effect on Shrinkage and Structure—Gas and Phosphide Eutectic Contents

BY GEORGE HAILSTONE

IN a Carnegie memoir presented by the author in 1913, liquid contraction in cast iron of fairly good quality was dealt with. (An abstract appeared in *THE IRON AGE*, Aug. 14, 1913.) The following were the conclusions of that investigation:

Liquid contraction is accompanied by a lowering of the specific gravity or density.

Casting temperature is one of the ruling factors in obtaining a dense and solid casting, and therefore also affects the liability to liquid contraction.

When castings have been cast with iron hotter than will conduce to liquid contraction, solid and dense castings result; when cast with iron too cold to conduce to liquid contraction, blowholes appear. Hence the casting hot gives dense castings, medium heat gives liquid contraction, and cold iron gives blowholes.

The more regular the sizes of the microscopical constituents the less will be the liquid contraction.

Conditions which conduce to a maximum solid contraction conduce to a maximum liquid contraction.

Gases appear to be held in more intimate contact in cast iron poured at a high temperature, and therefore tend to produce a more solid and dense casting.

Since the publication of the above the author has been able to extend his investigations on cast iron of commoner variety, the results of which are embodied in the following report. The methods of molding the test bars, measurement of the micro-constituents, specific gravity, hardness, and chemical analysis were those used in the previous investigation. The K test bars being cast in duplicate in each case, one only being used in the above tests, the long leg of the other was used for the tensile test, the bar being turned to 0.25 sq. in. in cross-section with 2 in. parallel.

PREPARATION OF SAMPLES

Ten sets of bars were molded in 12-in. square molding boxes, with facing sand as usually used for green-sand work. Great care was taken to insure, as far as possible, that the molds and methods of

running were the same in each case, the down and in gates being of the same size each time. The ten molds were placed side by side and cast, at intervals of 2 min. from a ladle containing 5 cwt. of iron tapped from the cupola.

The casting temperature was taken by means of a thermocouple and a millivoltmeter, the thermocouple being held in the ladle of metal during the

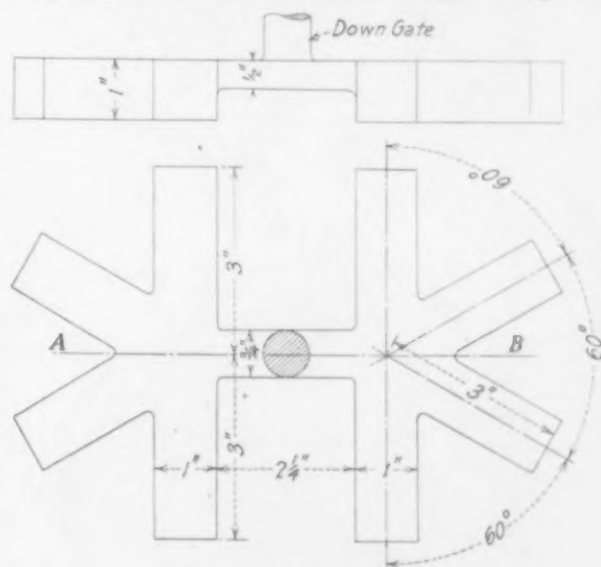


Fig. 1.—The Test Bar Used

pouring, and the reading of the millivoltmeter being taken as soon as each mold was full. The intervals of time between the casting of the ten bars and the temperature of casting are given in Table 1.

After being poured the castings were allowed to stay in the molds until the next day, when they were fettled, and then broken through the line marked A—B in Fig. 1 for examination. The analysis and specific gravity of each of the bars is shown in Table 2.

From these analyses it will be seen that the total



Fig. 2.—The Appearance of the Fractured Section of the K-Bars of Cast Iron

carbon in the whole series is practically constant, the bar cast last only containing a few hundredths of a per cent more than the bar cast first. The combined carbon, however, differs considerably, being greatest in bar 1 and gradually decreasing in the other bars with the reduction of the casting temperature. The silicon is practically constant

ture for the elimination of manganese sulphide.

From an observation of the specific gravity of the bars it will be noticed that the bar cast at the highest temperature has the highest density, the density diminishing as the casting temperature becomes lower in the subsequent bars.

TENSILE STRENGTH OF THE BARS

Table 3 gives the tensile test results together with the casting temperatures of the ten bars. It is very interesting to see that the bars cast at high temperatures yield the highest results, the strength decreasing with a reduction of the casting temperature. It will be noted the best results are obtained in bars 1 to 4, which have casting temperatures of from 1428 deg. C. to 1386 deg. C., a range in temperature of 42 deg. C. for this particular class of iron. The difference in strength between bars 1 and 10 is most marked, a reduction of 164 deg. C. in casting temperature reducing the tensile strength by more than 50 per cent.

Table 3—Tensile Strength and Casting Temperature

Bar No.	Tensile Strength in Tons Per Square Inch	Casting Temperature, Deg. C.
1	10.98	1428
2	10.94	1400
3	10.87	1390
4	10.50	1386
5	9.64	1361
6	9.60	1348
7	8.40	1330
8	7.65	1302
9	6.42	1272
10	5.24	1264

The appearance of the fractured surfaces of the K bars is shown in Fig. 2. Bars 1 to 5 exhibit the fracture of a close-grained solid cast iron of a light gray color. Bars 5 and 6 show a slight opening of the grain at the center, the color being of a shade darker gray than in the previous bars, while bars 8, 9 and 10 exhibit excessive openness in the center, and blowholes will be noticed to appear, being small in bar 8 and gradually increasing in size to a maximum in bar 10, bars 8, 9 and 10 also showing increasing depths of grayness in color.

On polishing the sections for the measurement of the microscopical constituents it was found that bars 1, 2, 3, 4 and 5 exhibited an even surface and were of a sound nature, therefore only one set of readings was taken, while bars 6 and 7 showed signs of liquid contraction, a large hole being present in No. 7. Bars 8, 9 and 10 exhibited liquid contraction also, blowholes being least in No. 8, larger in No. 9, and reaching a maximum in No. 10. Readings were taken from both the unaffected or sound areas and the affected or unsound areas in the case of the bars 6 to 10.

The mean dimensions of the constituents from 12 readings were taken in each case. Bar 1 had the highest density of the series, contained the smallest and thinnest flakes and plates of graphite and the largest areas of manganese sulphide. The size of the flakes and plates of graphite in the bars increases as their identification numbers, the areas of manganese sulphide diminishing in size.

With regard to bars 6 to 10, in each case the graphite flakes and plates were larger in the affected area than in the unaffected area, while the size of the manganese sulphide areas did not vary greatly in the different portions of the same section.



Fig. 3.—Photomicrograph, 120 diameters, of the Typical Structure of the Bars



Fig. 4.—Photomicrograph, 120 diameters, of Bar 10, Showing Large Area of Phosphide Eutectic

through the series, as is also the phosphorus. An interesting feature of the series is that bar 1 contains nearly double the amount of manganese than do the others; also the sulphur is much higher.

Table 1—Intervals of Time Between the Casting of the Bars and the Temperature of Casting

Bar	Time Cast		Casting Temperature, Deg. C.	Interval between the Casting of "K" Bars after Bar. No. 1, Min.
	H.	M.		
1	3	30	1428	..
2	3	32	1400	2
3	3	34	1390	4
4	3	36	1386	6
5	3	38	1361	8
6	3	40	1348	10
7	3	42	1330	12
8	3	44	1302	14
9	3	46	1272	16
10	3	48	1264	18

This is no doubt due to the top layer of metal in the ladle containing an excess of manganese sulphide, besides which the metal was at the proper tempera-

Table 2—Analysis and Specific Gravity of the Samples

Chemical Constituents	1	2	3	4	5	6	7	8	9	10
Total carbon	3.258	3.246	3.261	3.256	3.281	3.283	3.291	3.295	3.305	3.312
Graphitic carbon	2.830	2.840	2.862	2.891	2.915	2.926	2.951	2.987	3.012	3.126
Combined carbon	0.428	0.406	0.399	0.365	0.366	0.357	0.340	0.308	0.293	0.186
Silicon	1.907	1.875	1.900	1.898	1.894	1.904	1.915	1.901	1.902	1.910
Sulphur	0.114	0.097	0.092	0.096	0.096	0.094	0.094	0.093	0.093	0.092
Phosphorus	1.482	1.414	1.408	1.412	1.441	1.441	1.460	1.471	1.469	1.469
Manganese	0.420	0.270	0.270	0.265	0.268	0.268	0.267	0.265	0.266	0.264
Specific gravity of bars	7.281	7.262	7.240	7.225	7.201	7.158	7.123	7.085	7.012	6.936

HARDNESS OF SAMPLES

The hardness of the samples was determined by the Shore scleroscope, the diameter of the indentation being measured by means of the microscope micrometer. The results are quoted in Table 4. From the hardness numbers obtained by the scleroscope it would be inferred that the 10 samples were of approximately the same hardness, but on observing the diameter of the indentation it will be noticed that different diameters are obtained which bear a relation to the specific gravity and casting temperature of the samples. The higher the casting temperature and specific gravity of the sample, the smaller the diameter of the indentation. As in the previous investigation, it will be noticed that the Shore number does not bear any direct ratio to the density, although the diameter of indentation does.

Table 4—Hardness of the Samples

Sample	Hardness No. (Shore), Mean of 12 Determinations	Diameter of Indentation, Mean of 12 Determinations, In.
1	26	0.01589
2	27	0.01601
3	26	0.01625
4	26	0.01728
5	26	0.01796
6	26	0.01854
7	26	0.01926
8	27	0.01987
9	26.25	0.02126
10	27	0.02315

MICROSTRUCTURE OF SAMPLES

A transverse section was cut from the tensile test bars of the samples, polished, etched with a 5 per cent solution of sulphurous acid, and examined under a magnification of 120 diameters. Bars 1 to 6 exhibited a close structure, consisting of fine flakes of graphite, small areas of phosphide eutectic in a matrix of ferrite and pearlite. The photomicrograph, Fig. 3, which has been taken from bar 1, is the typical structure exhibited by these samples, although of course bar 6 exhibits a much coarser structure than No. 1.

As the number of the sample increases from 7 to 10 the structure becomes much larger, due to casting temperature, time the metal was allowed to stand in the ladle, etc. The photomicrograph, Fig. 4, has been taken from bar 10. This shows large flakes of graphite surrounded by areas of ferrite; also in the matrix are observed large areas of phosphide eutectic. These two photomicrographs are enough to convince anyone that the higher the casting temperature the stronger the resultant casting.

After examination the microsections were deeply etched with a 20 per cent solution of nitric acid, as suggested by Dr. J. E. Stead some years ago, to reveal the phosphide eutectic or phosphide of iron as the case may be, and examined under a magnification of 30 diameters.

The photomicrograph Fig. 5 is from bar 1, the strongest, hardest and densest iron of the series, which has also been cast at the highest temperature: a distinct network structure of the phosphide

proves that the condition of the phosphide eutectic has a great effect on the strength of cast iron, also that it may be controlled by casting temperature, etc.

GASES EVOLVED ON HEATING

Table 5 gives the amount of gas evolved from the specimens per gram, also the analysis of the gas.

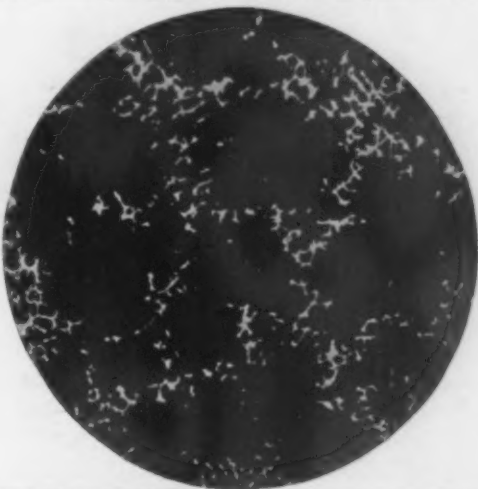


Fig. 5.—Photomicrograph, 30 diameters, Deeply Etched with 20 Per Cent Nitric Acid, Showing Phosphide Eutectic of Bar 1, the Stronger Iron

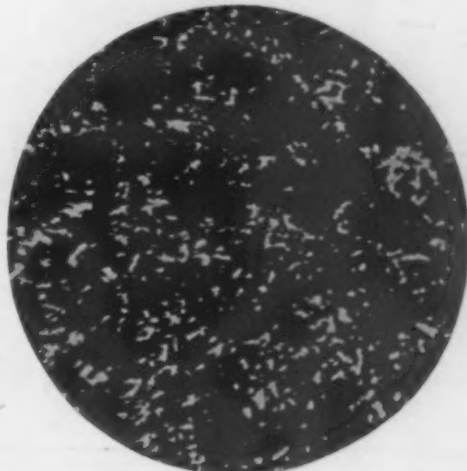


Fig. 6.—Photomicrograph, 30 diameters, Etched Deeply with 20 Per Cent Nitric Acid, Showing Phosphide Eutectic of Bar 10, the Weak Iron

It will be noticed that the lower the temperature of casting the higher the percentage of carbon dioxide, hydrogen, and nitrogen, etc., in the gas evolved; also that the carbon monoxide is decreased. The greatest volume of gas is evolved from sample 1 and the least from sample 10.

CONCLUSIONS

From the results obtained in this investigation the following conclusions are arrived at:

A cast iron of a given composition has a certain range of casting temperature to produce a solid, dense, and strong casting free from liquid contraction, which, in the case of the iron under investigation, is between the temperatures of 1428 and 1386 deg. C.

A cast iron poured at its proper casting temperature will always show a closer microstructure than otherwise, and the phosphide eutectic will be in network formation.

The more regular the size of the micro-constituents throughout cast iron, the less liable is the iron to liquid contraction.

Blowholes only appear in cast iron when that iron has been poured at a temperature as low or lower than the temperature at which liquid contraction takes place.

There is no doubt that the gases play an important part in the soundness of cast iron, as liquid contraction is always more severe in an iron containing a minimum amount of gas held in solution.

Table 5—Gas Evolved on Heating and Its Analysis

Sample	Cubic Centimetres Evolved Per Gram	Constituents, Per Cent		
		CO ₂	CO	H ₂ , N ₂ , etc.
1	0.402	0.98	29.62	69.40
2	0.362	0.99	28.46	70.55
3	0.310	1.21	28.25	70.54
4	0.261	1.36	27.89	70.75
5	0.206	1.61	26.46	71.93
6	0.172	1.82	25.05	73.13
7	0.126	2.32	24.76	72.92
8	0.101	2.58	24.02	73.40
9	0.085	2.96	23.78	73.26
10	0.056	3.21	23.03	73.76

eutectic will be noticed. The photomicrograph, Fig. 6, is from bar 10, the weakest and softest iron of the series; the phosphide eutectic in this case is evenly distributed throughout the section. This

Employing Methods That Make Good Workers

The Lowest Labor Turn-Over in the Industry Has Resulted from the Methods Used in a Middle Western Plant

—BY ROBERT T. KENT—

That the annual labor turnover of a factory can be reduced to an extremely low figure by care in the selection of the employees and the use of good methods of management, has been demonstrated by the experience of Joseph & Feiss Company, owner of the Clothcraft Shops, Cleveland. These shops are operated under scientific management which has been developed to a high degree. In the welfare work which has been started in connection with it and in the development of scientific methods of employment, which is necessarily a part of scientific management, the Joseph & Feiss Company has prob-

be heard and judged at the court of last resort in the factory before being disposed of.

EMPLOYMENT AND SERVICE

For the purpose of administering the function of the employment and welfare work, there has been established an employment and service department, which is considered one of the most important adjuncts of the management. All applicants for positions first come in contact with one of the heads of this department and information concerning each applicant is entered upon the blank re-

produced in Fig. 1.

It is important that these essential items of information be obtained.

English-speaking applicants are given the preference, but desirable employees are not rejected because they do not understand the language. They are, however, required to attend one of the classes in English which form a part of the factory service for its employees. It is stated that it is difficult to impart instruction to, and obtain the desired standards of output from those who do not speak English. Out

APPLICATION RECORD OF <u>Doe, Jane</u>				
DESIGNED BY THE JOSEPH & FEISS CO., CLEVELAND, OHIO				
APPLIED	Apr. 15, 1915	Address	1323 W. 48th.	For
Birthdate	Oct. 6, 1897	Birthplace	Cleveland, O.	Suitability
Immigrated	—	Parentage	Am.-Ger.	Married
Family	F. M. S. 14-12-16	B. 22		Wage Contrib.
REFERENCES	Mary Smith	3		
(IN OUR EMPLOY)	Susy Jones	3		
PREVIOUS EMPLOYMENT				
	Time	Capacity	Wage	Why Ended
John Smith & Co. (waists)	13 mo.	Hand sewing	\$7. wk.	Dissatisfaction
Brown Bros.	1 yr.	Clerical	\$5. wk.	low wages
Mrs. S. T. Baker, Lorain	2 mo.	Housework	\$4.50 wk.	To be at home nights.
American Knitting Co.	4 mo.	Clipping	\$5. wk.	Trouble with foreman
EMPLOYED	May 10, 1915, M.	Class	W. P. W. No. 842	Rate
Operation	Sleeves felled	Locker	1027	Fore. J. T.
Approved	S.	Signature	Jane Doe	Checked

Fig. 1—The application blanks provide for all statistics that may even remotely affect the efficiency of the prospective employee

ably progressed further than any other concern in the United States. The net result of its efforts in these two lines is a reliable, stable and highly efficient labor force. In 1910 on a standing payroll of 1044 employees, there were hired 1570 new hands, a labor turnover of 150 per cent. In 1914 the progress in the adoption of the methods to be outlined below had reduced the number of new hands to 290 on a standing payroll of 865, or a labor turnover of 33 per cent. Notwithstanding a decrease in the payroll, the product of the factory was materially increased by reason of the increase in the efficiency of the employees due to the methods of scientific management.

The manager of the concern, Richard A. Feiss, has somewhat radical ideas upon the handling of labor. His attitude toward employees is distinctly paternalistic. Every prospective employee is interviewed personally by him and at the interview ideals of the shop are explained and an outline is given of the methods of the management carried out in the factory and the reason for these methods as they affect the employees. No employee can be discharged without the justice of the discharge being certified by the manager. Thus, every employee who feels that he or she may have a grievance is absolutely certain that this grievance will

of 35 employees whose knowledge of English is imperfect only one has obtained an efficiency equal to that of the best worker of the same class of work.

The wage contribution to the family is obtained for several reasons. Other things being equal, preference is given to those who have to support themselves or whose contribution to the family support is necessary. Where an entire income is contributed to the family support, the efficiency of the worker is, as a rule, found to be materially lower and no incentive is present for the worker to improve. In such cases, a visit to the home is made by a member of the service department and an arrangement is established whereby a definite contribution to the family support is made, the balance being retained by the employee. Numerous instances might be cited to prove the efficiency of this method. For instance: The earnings of an employee were almost immediately raised from 13 to 22 cents per hour upon piece work by this arrangement.

The record of previous employment is obtained principally to indicate whether or not the applicant is what is known as a "floater" in the industry. The information is not considered of any particular value for purposes of reference and is never so used. Wherever possible, applicants give as their

reference members of the factory organization.

HIRING THE EMPLOYEES

Applicants are not hired at the time they make their first application, nor is any immediate decision arrived at regarding their suitability for employment. Decision is deferred for one or several days in order to bring all applicants in their proper relationship in the mind of the one who finally is responsible for their selection. Postponement also tends to reduce the number of floaters appearing on the payroll.

Application records are classified as to age, sex and apparent suitability. When a position is to be filled, several of the applicants whose records have already been obtained, are sent for, a definite time being set for their appearance. Enclosed with the notification are self-addressed postals which the applicant may use if it is impossible to keep the appointment at the time stated. At this second interview selection for immediate employment is made and the suitability of the prospective employee is more definitely determined.

PHYSICAL EXAMINATIONS

The better the health of the worker, the higher will be the efficiency, other things being equal. Consequently, effort is made not only to select workers whose health is good, but to maintain them in perfect health so long as they are members of the organization. A complete medical department, therefore, forms a portion of the equipment of the factory, a graduate nurse being in charge of the work. A dispensary, separate rest rooms, a waiting room and consultation room for the factory physician comprises the equipment of this department. The medical staff consists of a physician, oculist and dentist, the physician spending three mornings per week at the factory, the oculist two mornings and the dentist one morning.

All medical work at the factory is at the expense of the company. If medical attention outside the factory is required, it is at the employee's own expense save in exceptional cases where the employment and service department recommends that the expenses be borne by the company. Arrangements have been made by the company whereby this medical and dental service is secured outside at special rates. New employees are subjected to physical examinations and the time of their appointments with the employment and service department is regulated so as to coincide with the physician's visit. In regard to eye examinations of new employees, a preliminary examination is made by the nurse to discover any obvious defects. The oculist later makes a very thorough examination and if glasses are found to be necessary, prescribes them. Arrangements have been made whereby glasses can be obtained from reliable opticians in the city at one-half the usual rate.

The dental examination is also regarded as of

supreme importance, in that many chronic cases of headache, neuralgia or stomach trouble have been directly traced to neglected condition of the teeth or to poor dental work already done. Less than 15 per cent of the employees were found to have teeth that were properly cared for and in good condition; and it is stated that this percentage is considerably better than the average among employees in factories in Cleveland. A chart is made of the defective teeth and is given to the employee, together with an estimate of the cost of the work needed. No dental work is done at the factory excepting examination, advice and prophylaxis.

Information obtained from the medical, ocular and dental examinations is entered upon the record shown in Fig. 3. Not only is the applicant thoroughly examined at the time of the appointment, but this work is followed up from time to time as will be clearly indicated by examination of Fig. 3.

DETERMINATION OF MENTAL FITNESS

In addition to the physical tests described above,

QUALIFICATIONS: A 2+ M 3 13 13			
Languages	Eng. Ger.		
Education	7th grade (Public School) + 3 mo. Business College		
NOTES: Anemic, listless in appearance. Will need careful follow up physically. Desirous of working here because she has heard there is good chance for advancement. Father out of work most of the time. Mother came along when application was taken and promised to cooperate with nurse, etc.			

Fig. 2—On the reverse of the application record the interviewer notes such facts as will enable the employment and service department to follow up the applicant when employed

certain simple tests are made to determine the mental fitness of the applicant. These are to determine both his capacity for certain kinds of work and also the general fitness for advancement which depends, to a certain degree, upon mental fitness. Tests that are being developed under the direction of Prof. Walter Dill Scott of Northwestern University, include a test for the ability to follow instructions and a series of tests for dexterity. No matter how much care is exercised in the selection of workers, errors are bound to occur. Workers are often placed at jobs for which they are not suited and some are selected who are unfit mentally for the industry. The aim is to use these tests to aid in the selection and to avoid placing either normal or sub-normal persons at work for which they are unlikely to prove adapted.

The second purpose of the tests is to minimize errors in promotion. In the factory under consideration, a large percentage of the organization is moved up during the course of a year, it being the policy to fill positions of clerical or executive natures, in fact positions of every kind, by advancement. In the past, many mistakes have been made by advancing individuals to positions beyond their mental capacity. Eventual reduction in position resulting from this improper advancement is hu-

miliating to the individual and often causes his loss to the organization. In addition, the organization has suffered by reason of a position being poorly filled. The tests are expected to minimize errors of this nature.

It is impressed upon all that the tests just described are for inherent intelligence and not for education or character. The fact is emphasized that such tests cannot determine what a person can do but can help in determining what he cannot do. It is recognized that physical and psychological tests can be made instruments of abuse and that care must be exercised to see that they do not eliminate a large proportion of the community which, while not normal physically or mentally, must be used to assist in saving by the scientific selection every person capable of productive effort.

WELFARE WORK OUTSIDE THE FACTORY

Interest in the health of the employee does not cease with the hiring of him, but continues throughout his connection with the organization and extends beyond the bounds of the factory into the home. As soon as possible after an employee is hired, a member of the service department visits the home and investigates conditions there. It

is often found that influences in the home are contrary to the influences of the factory and that if the highest efficiency in his work is to be obtained by the new employee, bad influences in the home must be corrected.

Thus, unhygienic home conditions would counteract all conditions for health established in the factory. In many cases, it has been found among new employees that the practice of sleeping four or five in a room with the windows tightly closed was responsible for dullness, headaches and other disorders which affected the worker's ability. Sound advice and constant follow-up of such cases on the part of the employment and service department correct such conditions and have a marked effect in improving the efficiency and *esprit de corps* of the factory force. Also family troubles, financial and otherwise, are often detected and remedied in these home visits.

The company makes no excuses for its practice of "invading the privacy of the home," as it is often termed by objectors to these methods. It holds that the object of the company is to make money and that this can best be done by a happy, contented and efficient working force. The employee spends but eight hours out of the 24 in the



DATE OF BIRTH <u>3 Mch. 1884</u> EMPLOYED <u>4 Jan. 1903</u> NAME <u>Doe, Jane</u>				
<p>④ FAMILY HISTORY: Father died of cancer of stomach, 1899 Twin sister epileptic.</p> <p>④ HOME CONDITIONS: lives with mother, twin sister, ten yr. old sister and seventeen yr. old brother. Shares badly ventilated room with two sisters. Home neat and thrifty. 3 rooms & bath. Garden.</p> <p>④ INCOME CONDITIONS: Mother owns home and Lucy and 17 yr. old brother (earning about \$8.00 wk.) support family.</p> <p style="text-align: right;">SAVINGS: Yes</p>				
<div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">④ Apr. 8, 1914</p>				
DATE	COMPLAINT	TREATMENT	REMARKS	BY
④ 4-5-14	Examination	No organic trouble. Gen'l health good, but must have more sleep and avoid tea and coffee. Should consult oculist because of headaches. Tonsils enlarged.		m
④ 4-11-14	Headaches	CR 3/4 cyl 5/3 Fundus normal CR 3/3		
④ 5-16-14	Sore throat	Has glasses from optician (obtained 1 1/2 years ago) Homatropin necessary.		S.m.
④ 4-18-14		Cathartic. Gargle Homatropin administered. Shadow OP - sgl 150 CR - " 125 - cyl 025 + 180 Subj OP - " 150 CR - " 125 - cyl 025 + 180 5/5		m.
④ 4-25-14		Glasses satisfactory		S.m.
④ 7-30-14		Dental work partly completed		S.m.
④ 8-1-14	Sore throat	Cathartic. Gargle.		m.
④ 8-3-14	Anemic	Blaud's pills	Will go to summer camp. Constant follow up about fresh air & sleep necessary.	K
④ 9-30-14		Dental work finished.		W.
④ 10-19-14	Sore throat	Cathartic. Gargle.	Absent 8 ds. Consents to operation	m.
④ 11-2-14	Enlarged tonsils	Operation by M. at German Hospital	Successful	m.
④ 11-23-14	General follow up.	Health greatly improved.		K

Fig. 3—The medical record contains statistics regarding the physical condition of the employee during his entire connection with the plant. Poor workmanship can thus be often traced to poor physical condition. The physician's records are entered in green ink, the oculist's in violet ink, the dentist's in red ink and the nurse's in black ink.

factory, and his efficiency is vitally affected by what he does or influences to which he is subjected during the other 16 hr. Happiness and contentment of the employee are more often than not the result of conditions outside of the factory, and the company believes that by taking some cognizance of these conditions it can materially increase the health and happiness of the employees, and therefore their efficiency in the factory. The results

obey the same rules as do the workers in the shop. They also use the same dining room.

An extensive sociological experiment such as has been conducted in this factory can be judged only by its results. The results in this instance have proved to be highly satisfactory. The low labor turnover has already been mentioned. One or two other results are worthy of attention. In presenting these results, however, it should be borne in mind that they are not due solely to the service work which has just been described, but to the applications of the principles of scientific management of which the service work forms only a part, albeit a highly important one.

In the five years in which this experiment has gone on, the hours of labor have been reduced from 54 to 48 per week. The average wages per week have increased 37 per cent. The output of the factory has increased about 42 per cent, while the cost of manufacture has decreased about 10 per cent. It is thus evident that from the standpoint of both employer and employee, the experiment has been a success, financially, physically and morally.

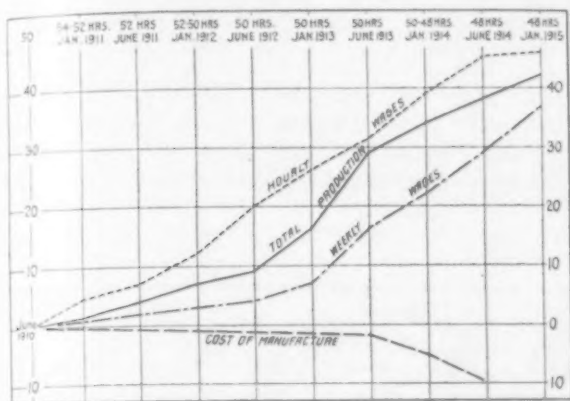


Fig. 4—The methods of scientific management have raised wages, increased production, shortened hours and decreased the cost of manufacture

that have been accomplished bear ample testimony to the soundness of these ideas.

The employment and service department is not regarded by the employees as meddling or interfering with their liberties and pleasures. On the contrary, employees look upon the members of this department as friends to whom they can go at any time for advice upon any subject whatever, whether it has to do with their work in the factory or their affairs outside of it. As a matter of fact about one-fifth of the entire working force consults the department every day.

WORKING CONDITIONS

Of the working conditions existing in the factory it is hardly necessary to speak. It goes without saying that a factory which has the high ideals of this one will necessarily furnish the best working conditions possible. It is sufficient to say that the shop proper is splendidly lighted, well ventilated and kept scrupulously clean. Chairs are provided for all workers and every facility has been adopted that will minimize fatigue. In addition to providing working facilities of the highest order, the company has also provided facilities for rest and recreation. The entire basement of the factory building is given over to this purpose. Shower baths are installed here for the employees and in addition there is a large dining room in which the employees can eat lunches which they have brought with them or they can obtain prepared lunches from the factory kitchen, practically at cost. Nearly all of the employees avail themselves of this privilege. The remainder of the basement is given over to a recreation floor on which dances can be held or games played, and these facilities are used to the limit every noon and after working hours. A branch of the Cleveland public library is maintained in the employment department and is well patronized. A savings bank conducted by the company for its employees is another institution that is well patronized.

The spirit of democracy pervades the entire establishment. The office force is regarded as being no better or no worse than the factory force. They keep the same hours, have the same privileges and

One-Slag Process for Basic Electric Steel

A one-slag process for making basic steel in an electric furnace, involving a saving of time, current, lime and other materials, is covered by a patent (U. S. 1,187,623—June 20, 1916) granted to Ernest Humbert. The slag is used in such a way as to overlap from one heat to the next, forming the finishing slag of one heat and the starting slag for the next. After performing its duty as a dephosphorizing slag it is poured off and a new slag introduced which finishes this heat and in turn starts the next one. The finishing slag is introduced as a mixture of lime, silicon and carbon, with generally some fluorspar. Calcium carbide is thus formed as usual. With this slag the finishing operations, consisting of the additions of ferromanganese, ferrosilicon, etc., are performed. This slag is left in the furnace after the metal is tapped. It may be removed and part of it returned to the furnace.

To this old slag in the furnace iron oxide as scale, or any other oxidizing material, is added, sufficient to oxidize the carbon left in the slag as well as the calcium carbide and to leave an excess of the oxide. This converts the slag into an oxidizing one, and the heat of oxidation of the calcium carbide is so great that, combined with the residual heat in the furnace, the resulting oxidizing slag is liquefied. Fluorspar may be added if necessary. The slag now consists of lime, silica and iron oxide and perhaps fluorspar.

Upon this slag the metal to be refined is introduced and the slag, in rising through the metal, is completely mixed with it, expediting the dephosphorization, which begins at once and is completed in a comparatively short time. The slag containing the phosphate is then removed and a new finishing slag provided.

The inventor states that as soon as liquid Bessemer metal has been poured in a good boil is secured, and that in 10 minutes the reduction of phosphorus is practically complete. Besides the savings, an improved product is claimed because of the more thorough dephosphorization.

The shipyard of Yarrows, Ltd., at Esquimalt, British Columbia, established two or three years ago by Sir Alfred Yarrow, of the Yarrow Shipbuilding Institution of Great Britain, is described briefly in a recent issue of *London Engineering*. The yard is located across the Strait of Juan de Fuca from the State of Washington, and was established as a nucleus for a large enterprise which is expected to develop when the war brings back commerce to its normal state. It can accommodate vessels up to 312 ft. in length and of 55 ft. beam and of 3000 tons gross measurement. A wharf over 500 ft. in length gives space for overhauling and repairing vessels on both sides.

The Steel Industry in the War Zone

Important War Problems in Minette Ores and Their Bearing on the Industrial Future of France and Germany

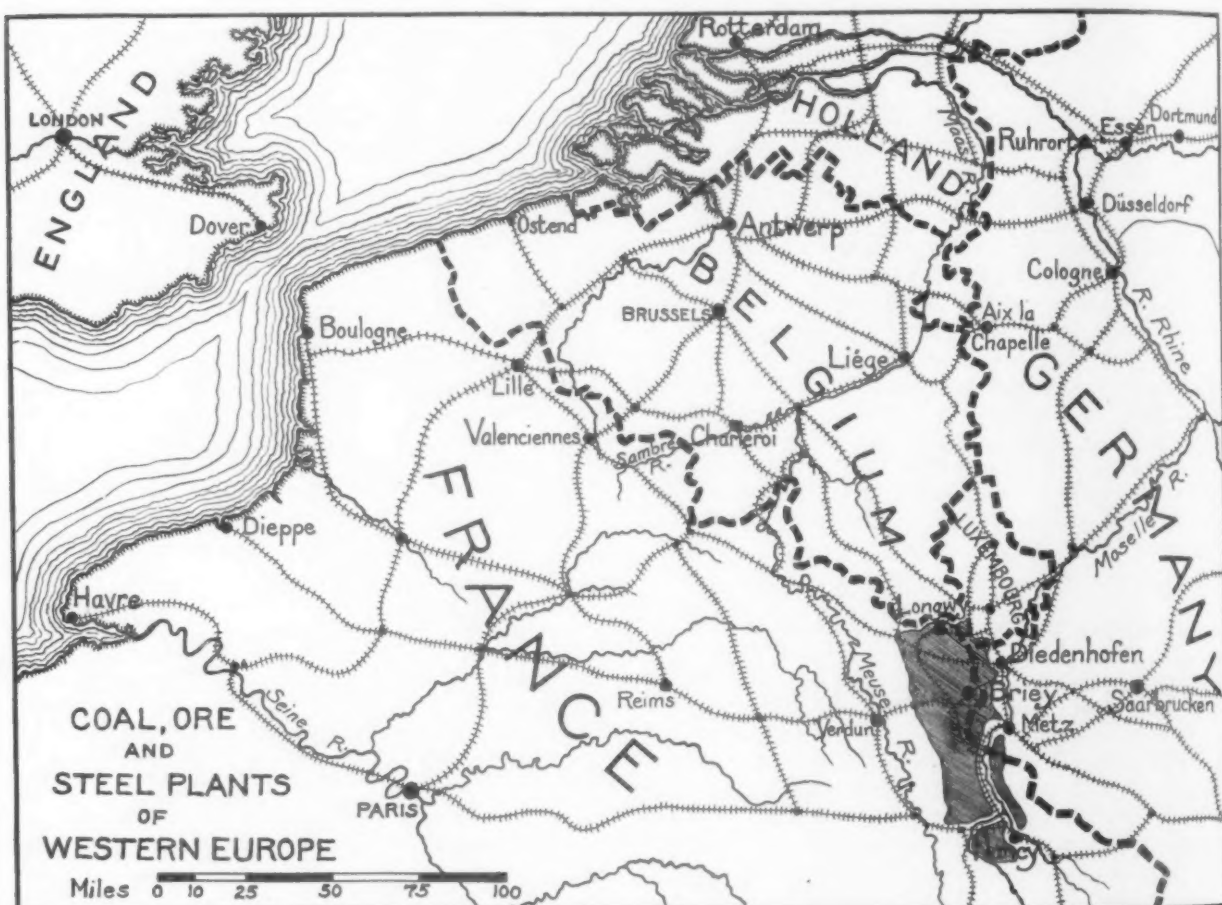
BY H. H. CAMPBELL

At the close of the Franco-Prussian War, when Germany took from France the territory that has been the cause of so much trouble, the ore deposits in Lorraine were looked upon as of little importance; but since then the basic Bessemer process has come into its own and the whole steel industry of the continent now centers around the iron ore in German and French Lorraine. This mineral area was described by the writer in *THE IRON AGE* of

business, either because it has steel plants or mines of ore or coal, or because it is a shipping port.

LOCATION OF STEEL PLANTS AND DEPOSITS OF ORE AND COAL

Steel Plants.—The steel plants in eastern France are mostly near Longwy, Briey and Nancy; in Belgium near Charleroi and Liege; while in German Lorraine they are at small places like Rombach and



The Shaded Portion of the Map Represents the Minette Iron Ore Field

July 15 and 22, 1915, and was again referred to in articles on the steel industry of Germany, France and Belgium, published in these columns May 11, 18 and 25, 1916. It was stated that the general average of the ore sent to the blast furnaces runs from 30 to 35 per cent in iron, and that the pig iron contains about 2 per cent of phosphorus, so that it is just fitted for the basic Bessemer process.

The articles just mentioned dealt with the subject from a metallurgical standpoint, but we must now take a bird's-eye view of the situation, because this ore district after the war will be a bone of contention between the warring nations. In order to present the subject clearly, a map is given which has been drawn especially for this article. A few cities like Paris, Lille and Rheims are marked so that the reader can get his bearings, but almost every place shown is an important factor in the steel

Hayingen, which are not shown on the map, because they are close to Dillingen. There are also steel plants at Dudelingen in Luxemburg and at Differdingen near Luxemburg. In Westphalia the only places given on the map are Ruhrort, Essen and Dortmund, but there are important steel works at Hoerde, Bochum, Oberhausen and elsewhere. The map does not give these details, being intended to show only the general situation. There is also a steel plant at Aachen (Aix la Chapelle) in the Rhine province.

Coal Fields.—Valenciennes in France; Charleroi and Liege in Belgium; Saarbrücken and Westphalia in Germany.

Shipping Ports.—Rotterdam in Holland; Antwerp in Belgium; Boulogne and Havre in France.

Ore Deposits.—The shaded portion of the map represents the Minette ore fields, occupying a rect-

angle measuring 60 miles north and south by 20 miles east and west. This deposit really extends across the frontier into Belgium, but this is not shown on the map, because Belgium only produces one-third of 1 per cent of the output of the whole field. There are three countries—France, Germany and Luxemburg—which share this deposit, while Belgium is an important factor in the problem as a manufacturer of steel. We will consider these four countries separately and then take a view of the field as a whole.

THE SITUATION IN FRANCE

In French Lorraine there are three separate ore fields—Longwy, Briey and Nancy. Of these Briey is the most important, producing two-thirds of all the ore mined on the French side of the border. It was about ten years ago that men realized the full extent of the deep-lying deposits around Briey, and ever since there has been a rapid increase in production; but France is not able to use all this ore, in spite of the building of several new steel works. French steel makers are handicapped by being 150 miles from the coal mines at Valenciennes, so that much of the coal must be imported from Belgium and pay a duty. This tariff acts as a bounty given to German and Belgian manufacturers to enable them to make steel cheaper than it can be made in France, and as a consequence half the ore raised in the French district is exported to Belgium and Germany. In addition to these shipments to neighbors, ore is sent to Great Britain and other countries, the total exports in 1913 amounting to 10,067,000 tons, which was more than the output of either Spain or Sweden. In other words, France exported more iron ore in 1913 than any other country in the world, and 40 per cent of this went to Germany.

GERMANY

There are four separate steel districts in Germany that are founded on Minette ore, the first being the narrow strip along the frontier, just north of Metz. The ore comes from 48 different mines, and in 1913 there were 18,000 miners at work producing 21,153,000 tons of ore. A little over half was smelted close by, while the rest was divided about equally between Westphalia, Saarbrücken and Luxemburg, although France and Belgium received a little. There are several up-to-date steel works in this section, but the only well-known town is Diedenhofen, which often appears on our maps as Thionville, which is its old French name.

Another separate district is around Saarbrücken, where there are mines of very inferior coal. Years ago steel works were built there, ore being brought from Luxemburg, but during the last quarter of a century there have been many small improvements in saving fuel, so that it is not such a great advantage to-day as it once was to be alongside a coal mine, and it is not impossible that the steel works at Saarbrücken will be moved to the ore field before many years.

In the province of Westphalia are a large number of important steel centers, but it was thought sufficient to put only three places on the map. Dortmund and Essen are both situated in the coal regions, while Ruhrort is the chief harbor for shipping material to Rotterdam for export, and for receiving ore that has come from Sweden or Spain and has been put on river steamers at the Dutch port. Westphalia is one of the largest steel producing districts in the world, ranking next to the Pittsburgh territory. More than half the raw material is brought from the Minette region, the re-

mainder coming from abroad. The last of the four districts referred to is Aix la Chapelle, which remelts pig iron coming from Luxemburg.

THE DUCHY OF LUXEMBURG

Luxemburg has an area of only 1000 square miles, equivalent to a square 32 miles on a side, and its only claim to importance rests on its ore deposits. Large amounts of ore are exported to Germany and Belgium, while large quantities of pig iron are also made, part being used by basic Bessemer steel plants in the duchy, the rest being sent to the steel works of Belgium, Westphalia and Aix la Chapelle. For a generation Luxemburg has had a commercial treaty with Germany, which from an industrial point of view has made this territory a province of the empire, so that usually the statistics giving the production of ore, pig iron and steel combine the output of the two countries.

BELGIUM

The total production of ore in Belgium in 1913 was only 149,000 tons, while the imports were 7,085,000 tons, from which should be subtracted 725,000 tons of re-exports. Over 90 per cent of all the ore came from France, Luxemburg and Germany, and contained less than 35 per cent of iron. The blast furnaces made 2,485,000 tons of pig iron, most of it going through the basic converter, the steel output being 2,467,000 tons; so it is plain that the whole iron and steel industry of Belgium rests on the ore from the Minette district.

PRODUCTION OF MINETTE ORE

The accompanying table gives in metric tons the amount of ore produced in the whole Minette field at different periods and the tonnage for each country in 1913:

	Ore.	Equivalent Pig Iron.
1872, whole district.....	3,000,000	1,000,000
1895, whole district.....	11,000,000	3,700,000
1903, whole district.....	22,000,000	7,300,000
1913, Germany.....	21,150,000	7,050,000
France.....	17,300,000	5,770,000
Luxemburg.....	6,500,000	2,160,000
Belgium.....	150,000	50,000
1913, total.....	45,100,000	15,030,000

Thus 45,000,000 tons of ore was mined in 1913, equivalent to 15,000,000 tons of pig iron, or 56 per cent of the combined output of Germany, Luxemburg, France and Belgium, so that more than half the pig iron produced in those countries had its origin in Minette ore, and most of this went into basic Bessemer steel. These figures contrast with the record for 1872, which was the year following the Franco-Prussian War, when the output of the whole field was equivalent to only 1,000,000 tons of pig iron, while not a pound of it went into steel.

THE MARKET

On the map that has been given we may draw a triangle with its points at Dortmund, Charleroi and Nancy, which will have an area about one-quarter that of the State of Pennsylvania, and will include most of the ore deposits, coal mines and steel plants of western Europe. In 1913 this triangle absorbed 45,000,000 tons of Minette ore and also 25,000,000 tons from Sweden, Spain and other countries. About 20,000,000 tons of steel was made here, or two-thirds of the output of the United States.

It is needless to prove that all this steel cannot find an ultimate market in the immediate vicinity of the mines, while neighboring countries on the south and east do not buy very much steel. The outlet in Switzerland is limited, and both Austria and Russia have protective tariffs, while across the Channel is England, which has taken quite a little

steel from Germany in the past, but which will be a poor customer for many years to come. It is therefore necessary for a good part of the product of this region to find a world market, and so the map shows the seaports of Antwerp, Rotterdam, Boulogne and Havre, although these last two export only small amounts of iron and steel. The French works at Briey are 250 miles from Boulogne, which is the nearest good French seaport, and over 300 miles from Havre, these distances being formidable on the miserably managed French railroads.

The steel works in both French and German Lorraine must bring coal 100 miles or more, and then the nearest port is Antwerp, 170 miles away. Westphalia is even more unfavorably situated, since for every ton of pig iron made 3 tons of ore must be brought 150 miles, and then the finished material must be sent by river steamers 100 miles to Rotterdam, where it must be handled again. The plants in Belgium have the best location, for they are right alongside the coal mines of Charleroi or Liege; they bring ore only 100 miles and are within 70 miles of Antwerp. It is evident that Antwerp is the gateway to the Minette district, and Germany will try to retain possession of her new front door.

WAR PROBLEMS

Until we know how the war is going to end, it is almost a waste of time to theorize about the future of the Minette district, but we ought to understand the conditions as they are to-day. The battle line is not shown on the map, for it may change any day; but the reader may draw it for himself. Take a pencil and draw a line due south from Lille, until a point is reached west of Rheims; then go east through Rheims to Verdun; then due south until a line drawn east will pass about half way between Antwerp and Metz. This will show the line of trenches as it has been for nearly two years, and one glance will explain why Germany is willing to buy Verdun at a price that staggers humanity. If Verdun falls, then Nancy may come next; and if Germany gains that area and holds what she now has, France will disappear from the list of important producers of iron and steel, while Germany will control the whole steel industry of the continent. Even as things are to-day, the area held by France produces only one-twentieth part of the output of the Minette field.

It may be, however, that France will have her way, and annex a part or perhaps the whole of German Lorraine. This would upset the present industrial balance, for the steel works in Lorraine that are owned by German companies would not be able to market their product in Germany on account of the tariff. There is a third possibility, for the frontier may remain just as it has been for nearly half a century, and perhaps the Allies will adopt a policy of non-intercourse with Germany. Such an agreement would deprive France of a market for the 4,000,000 tons of ore that was sent to Germany in 1913, and it would also destroy a system of interchange of ore that has grown up on account of local conditions. In fact, it would be almost impossible to maintain such an arrangement on account of the peculiar position of Luxemburg. This country was not a partner of Germany, but a helpless victim, and should not be subjected to any boycott; yet if Luxemburg is left free, then ore can be bought from France and sold to Germany, merely passing through the duchy just as some undoubtedly does to-day.

INTERCHANGE OF ORE

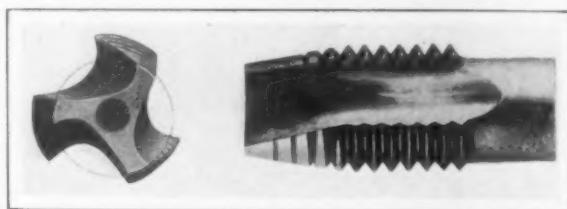
In 1913 France sent 4,065,000 tons of ore to Germany and received 807,000 tons in return; Luxem-

burg received 2,896,000 tons from Lorraine, and sent 1,578,000 tons to Belgium; and so every different part of the ore fields sent large amounts to every other part. This interchange is due in great measure to the desire to get a self-fluxing mixture, for some of the ore both in France and Germany contains an excess of lime, while some in both countries carries too much silica. For this reason blast furnaces and steel companies in Germany, Belgium and Luxemburg have bought ore mines just across neighboring political frontiers, so that a routine movement of ore from their own mines to their own steel works, a distance perhaps of less than 50 miles, appears in international statistics in the columns of imports and exports. On account of these conditions any prohibition of exports from the mines owned by German steel works would virtually be confiscation of private property.

It is not likely that the final treaty of peace will overthrow the complex industrial and commercial machinery that now exists, since men realize that political and sentimental considerations ought to give way to economic facts; but we must wait to find out how all the conflicting conditions are to be harmonized.

Interesting Type of Three-Flute Tap

A tap differing materially from those which it formerly made has been placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. The distinctive feature of it is the shooting of the chips in advance of the tap in long, unbroken curls which have caused it to be known as the "Gun" tap.



A Three-Flute Tap in Which the Cutting Is Done by the Portion Ground Away at an Angle, While the Remaining Threads Serve as a Lead Screw to Steady the Tap

This result, it is claimed, is secured by the peculiar form of construction used at the point. It is also possible to use a single one of these taps where two and three of the ordinary type used successively have been formerly required.

The cutting edges at the point of the tap are ground at an angle to the axis, which it is pointed out enables the tap to cut with a shearing motion. The angularity is relied upon to deflect the chips and cause them to curl out ahead of the tap instead of collecting and breaking up in the flutes as is sometimes the case. This eliminates clogging and the taps do not have to be backed out when deep holes are being threaded to remove the collected chips from the flutes. The hook on the cutting edge does the threading, while the remainder of the threaded portion of the tap acts in a manner somewhat similar to a lead screw without any cutting action, thus tending to hold the work true to the lead.

When it becomes necessary to grind the tap, this is done only on the angular cutting edge, instead of in the flutes. It is possible to repeat this process as often as may be necessary until there are only two or three full threads left without, it is emphasized, impairing the accuracy of the thread cut.

The name of the Duplexo Vacuum Cleaner Company, Inc., 429 Kent Avenue, Brooklyn, N. Y., has been changed to Duplexo Metal Stamping Company, Inc.

Bronze Alloys for Automobile Work*

Test Bars Not Always a Guide to the Quality of the Casting—Value of the Microscope—Composition and Properties of Commercial Alloys

— BY W. M. CORSE AND G. F. COMSTOCK —

EXPERIENCE in the bronze casting business has demonstrated the need of data on the physical and chemical properties of alloys that are not available in handbooks or other sources of information on the subject. Tables showing such properties determined from actual practice, which may be termed experience tables, are rare; some data exist, but they are usually in the private files of individuals or companies. The Bureau of Standards at Washington reports daily requests for such information and states that there is great difficulty in obtaining data that enables them to make correct replies.

With this need in mind the committee on non-ferrous alloys of the American Society for Testing Materials discussed at a recent meeting the advisability of publishing such data as might be compiled from existing experience tables. On account of the fact that publication of data by that society is made in a formal manner, usually as specifications, it was thought best to delay so as to allow the experience tables to be checked by further work. The need was fully realized, however, and it is with that idea in mind that the table included in this paper was compiled.

VARIATION BETWEEN BARS AND CASTINGS

One very important point should be emphasized in connection with the use of the table. Most tests are made on standard test bars either attached to castings or cast separately. Test bars cut from castings where this procedure is possible, show conclusively that a variation exists between results on standard test bars and the metal in the castings themselves.

Castings may show higher or lower results, depending on the design and size of the casting itself. The latter is usually the case on account of the fact that the average size of castings exceeds the test bar size. It has been proved conclusively that the rate of cooling and the shape of the casting affect the results markedly.

Alloys of high shrinkage are much more liable to show internal strains due to practical inability to feed the shrinkage properly, so that the net strength is the difference between the true value for the metal and the internal strains caused by this shrinkage. Manganese bronze, for example, normally shows an average ultimate tensile strength of from 65,000 to 75,000 lb. per square inch. It is not uncommon to find this lowered to 30,000 or 40,000 lb. per square inch in actual castings.

Copper-tin alloys, such as phosphor-bronzes, do not exhibit high shrinkage, but show the same proportional discrepancy in strength, on account of large crystal growth and the formation of a coarse network of the high tin eutectoid, which is very hard and brittle. Thurston, for instance, in his standard work on alloys, quotes from Major Wade's report of 1856 on "Experiments on Metals for Cannon," in regard to gun bronze containing 10 per cent tin that 83 test bars from gun heads of castings averaged about 30,000 lb. per square inch tensile strength, while 32 small bars averaged about 42,000 lb. Also "The average of 12 gun heads was one-half (in strength) of that obtained from small sample bars cast with the guns." The area of the cross-section of the casting, as well as its design, therefore, has a very important bearing on the subject and should always be taken into account in engineering work.

Improper foundry practice affects the tests of any alloy to a very marked extent, so that two metals of

the same chemical analysis may show very different results when handled by different foundries. The latter statement is almost self-evident, but many engineers do not realize the effect of small amounts of impurities, some of which are acquired during the melting process, on the final result.

We may learn two things from the above. First, to secure, if possible, the maximum amount of information on castings themselves even at the expense of a few spoiled pieces. Second, to employ the most reliable foundryman you can find, as the best practice is none too good with the appliances existing in the foundry.

VALUE OF MICROSCOPE

To the above might be added a suggestion to examine the structure of the metal with the microscope. We all know the value of such a procedure with steel, but so little work has been done with the bronzes that its value here may easily be overlooked. The high copper-aluminum alloys, commonly known as aluminum bronzes, are very interesting from a metallographic standpoint.

In two metals of the same composition but with different structures, due to "self-annealing" or heat treatment in the mold during the casting process, tests show a difference in ultimate tensile strength of 11,000 lb. per square inch and in elongation of 10 to 12 per cent. The microscope was a distinct help in explaining these differences. Our experience in the last two years indicates increasingly the value of metallography as applied to bronzes.

Many engineers believe that when figuring loads it is not safe to go above the value of the true proportional limit as shown by the extensometer readings in the tension test. An interesting point has arisen recently in connection with aluminum bronze. The fatigue test as made with several types of machines indicates clearly that the primitive yield point as shown by the tension test is not the true yield point of the material. The endurance or fatigue resistance of this alloy exceeds that of manganese bronze, or even of steel under certain conditions, although the primitive yield point of manganese bronze is above that of aluminum bronze. It would seem therefore that valuable information might be obtained by considering the fatigue resistance of a material in addition to the usual properties shown in the table.

MATERIALS FOR BEARINGS

We have avoided specific statements or recommendations about materials for bearings because it is difficult to predict the result with several other variables undetermined. For instance, the hardness of the steel shaft and its machine finish are as much a factor in the selection of the bronze as the properties of the bronze itself. Moreover, the quality of the surface finish needed on the bronze bearing is also determined by the ability of the bronze to conform to the steel. It is evident that as the bearing pressure increases the hardness also must increase to avoid flowing. In order to have a satisfactory hard bearing, it is necessary to have a finely machine-finished surface on both bearing and shaft because they will not conform as will softer metals.

Inasmuch as there are many different bearing conditions of pressure and speed, it can be seen that no one bronze can fill all the needs of the automobile engineer. In a general way tin and zinc harden bronze and lead softens it. The use of zinc in small proportions is principally for deoxidizing purposes, but has a detrimental effect on the wearing properties. Consequently, when conditions require hard bronze bear-

*From a paper presented at the semi-annual meeting of the Society of Automobile Engineers, June 12 to 16, 1916. Mr. Corse is manager bronze department and Mr. Comstock is metallographist, the Titanium Alloy Mfg. Company, Niagara Falls, N. Y.

Specifications and Results of Tests of Commercial Bronze and Brass Castings

Name of Alloy	COMPOSITION								TENSILE TEST				HARDNESS		COMPRESSION TEST		Uses, Remarks, Etc.		
	Copper, per Cent	Tin, per Cent	Zinc, per Cent	Lead, per Cent	Alumi-num, per Cent	Iron, per Cent	Manga-nese, per Cent	Phos-phorus, per Cent	Yield Point, Thousands of Lb. per Sq. In.	Elastic Limit, Thousands of Lb. per Sq. In.	Ultimate Strength, Thousands of Lb. per Sq. In.	Elonga-tion in 2 Inches, per Cent	Reduction of Area, per Cent	Brinell	Sclero-scope	Elastic Limit, Thousands of Lb. per Sq. In.		Per Cent Reduction in Height After Loading to 100,000 Pounds per Sq. In.	
Bronze	80	20						tr.							136		25-40	3-1	Dies, bells, bearings, etc.
Grade A bridge bronze	80	20						1 (a)										6-10	In bridges, for contact with hard steel under pressure above 1500 lb. per sq. in.
Special phosphor bronze	80	20						0.2 (i)									24 (i)		Disks for draw bridges
Grade B bridge bronze	85	15						1 (a)									19-23	12-25	In bridges, for contact with soft steel at pressure below 1500 lb. per sq. in.
Special phosphor bronze	85	10						1 (a)									19-23	12-16	Trunnion bearings.
Hard bronze	82.5-83.5	13-14.2	1.1-2.9	0.8-1.2					23-25	15-19	23-27	tr-4	tr-4	20-24					Bearings and bushings.
Gear bronze	85	13	2								37-39	2-3	1-4						Gears.
Phosphor bronze	79.5	12		7.5				1			30-34	1-2		74-80					Bushings and bearings not subjected to shock.
Tough bearing bronze	85.5-86.5	10.5-12	1.5-3.5	1 (a)		0.25 (a)	0.15 (a)		22-25	15-20	24-32	2-15	2-15	80			15.5-16.5	25-27	Bearings, gears, etc.
Stone's English gear bronze	89	11						0.5			35-40	6-10	7-9	72-77					Gears and worm wheels.
Gear bronze	89	10.5									31-35	6-10							Worm, spur and bevel gears.
Cast gun metal, G. U. S. N.	87-89	9-11	1-3	0.2 (a)		0.06 (a)			15 (i)		30 (i)	15 (i)							Valves, gears, etc., and where strength and incorrodibility are desired.
Tough bronze	85.7-89.3	9-11	1.5-2.5	0.3-0.8						12-16	26-34	10-22	9-21						Durable castings.
Gun metal bronze	86-89	8-11	1-3								33 (i)	14 (i)		70-74					A.S.T.M. tentative specifications.
Bronze	88	10									32-38	14-18							Hard bearings, hydraulic work, valves, machine parts, etc.
Grade D bridge bronze	88	10	2					0.25 (a)	19-23		33	14	12-15	70-75		14 (i)	27-29		Gears, worm-wheel, nuts, etc.
Gun metal	88	10	2								32-38	14-18				14.5-15			Bearings for heavy pressures and high speeds, thrust collars, steam fittings, hydraulic work.
Bronze 2, U. S. N.	87-91	8 (i)	4 (a)	1 (a)		0.5 (a)		0.5 (a)			30 (i)	15 (i)							Water-tightness and bearing qualities in thin sections.
Cast phosphor bronze, Pc. Grade 1, U. S. N.	85-90	6-11	Remainder	0.2 (a)		0.06 (a)		0.3 (a)	25 (i)		50 (i)	25 (i)							Castings for strength and incorrodibility.
Bronze	90	10						tr.	22-24		35-40	15-18	15-20	65-70		15.5-16	28-29		To resist acid, and for thrust collars and disks under high pressure.
Bronze	90	10									32-36	10-14		67-70					Pumps, collars, bearings, and to resist corrosion.
Bronze	89.5	10														15			Worm wheel rims (copper content includes manganese).
Bronze	89	10		1							22					22			Worm gearing, safe working stress: 7000 lb. per sq. in.
Bronze	88	10		2					19-23		30-35	15-20	18-26	65-70		15	28-29		Gears under moderate service, and for good machinability.
Cast phosphor bronze, Pc. Grade 2, U. S. N.	72-81	9-13	Remainder	8-11				0.7-1	20 (i)		35 (i)	18 (i)				15-20			Gun fittings.
Bronze	79.7	9-11		8-11				0.7-1	20		30	6							Bushings and shaft bearings.
Phosphor bronze	80	10		10				0.25			28-32	5-7							S. A. E. specifications.
Phosphor bronze	76.75	10		10				0.7-1											Bearings for high speeds and heavy machinery.
Grade C bridge bronze	80	10		10				0.8								15-20			Ordinary machinery.
Bronze	80	10		10												18			Bridge bearings.

ings, the tin content must be relatively high. It sometimes goes to 15 per cent in automobile work.

Lead also may go to 30 or even 40 per cent for special work, such as in racing cars, but its effect should be considered in relation to the tin content as well as by itself. It is a good lubricant in bronze. Present practice frequently calls for a combination bearing with a relatively hard back and a soft lining of babbitt metal. The selection of babbitt should be determined by the thickness of the lining, and pure tin or solder can be used if the lining is very thin.

SUMMARY AND CONCLUSIONS

In order to aid engineers in choosing the right alloy, we must first recognize several facts:

Standard test bar results do not necessarily represent the material in the castings. Wherever possible, secure tests from pieces cut from castings as a check on the properties the metal is shown to possess from test bar results.

The aid of competent foundrymen should be secured in making castings as the chemical analysis or standard test bar results do not tell the whole story.

The microscope is as important in determining the properties of bronze as those of steel. All that is needed is more information on the subject.

The endurance or fatigue test is an important aid in determining the quality of a bronze and like the metallographic test should be used to be appreciated.

The proper composition to use in automobile work depends on the kind of service required. For conditions requiring hardness, high tin is needed. If conformability is more essential, the lead content should be high.

Published data is very meagre, so that any additional reliable information will be a distinct gain to the literature of the subject.

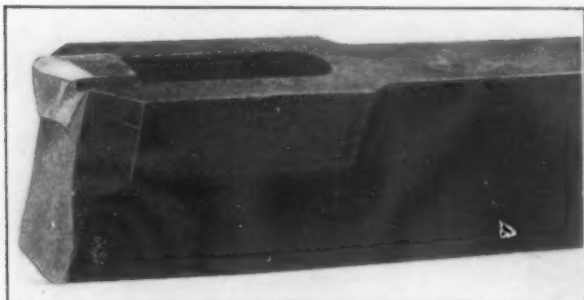
(The paper also contains a large assortment of photomicrographs.)

New Tool Employing Inserted Cutters

A tool in which reliance is placed upon the contraction of the holder due to cooling to hold an inserted cutter in position has been patented by H. P. Parrock, general manager Lumen Bearing Company, Buffalo, N. Y. It is of course designed for use in connection with metal-working machine tools. The holder may be made of ordinary steel, while the cutting point, say of high-speed steel or of Stellite, may be removed and replaced when worn out. Loss of high-grade material, as by grinding or sharpening the solid tool, is eliminated on account of the reduced cross-section of the cutting point.

The holder is made by drop forging, for example. The groove in the top face is ordinarily made slightly shallower than the height of the cutting point used, and the width of the groove is slightly less than that of the cutting point. The grooved end of the shank is heated and the cold cutting point forced into position in it. The heated side walls of the groove are then pressed or hammered to make contact with the sides of the cutting point and thus insure a tight fit between the two parts when the walls cool.

In some cases the cavity between the end of the cutting point and the end wall of the groove is filled with an infusible clay or molding sand and the upper face of the cutting point and the adjacent portions of the side walls of the groove projecting above the cutter



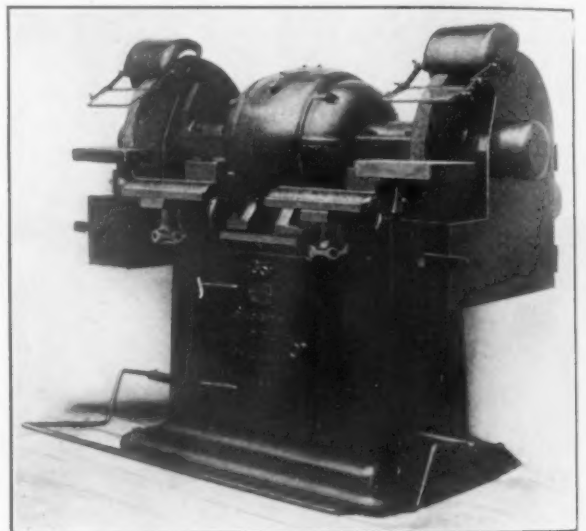
In This New Type of Tool Reliance Is Placed upon the Contraction of the Holder in Cooling To Hold the Inserted Cutter Firmly

are subjected to a welding heat, a puddle of molten metal being formed on the upper face of the inserted portion of the cutting point by feeding an iron wire into the welding flame. This is designed to form a welded connection between the upper face of the cutting point and the adjacent portions of the side walls of the slot, and the sand or clay prevents the metal from filling the cavity at the inner end of the cutting point. The welded connection, together with the shrink fit brought about by the forcing of the heated metal of the holder into contact with the cold cutting point, is relied upon to secure the cutting point firmly and rigidly in the holder.

When desired to remove the cutting point, the metal welded to the upper face of the cutting point must be removed either by remelting or cutting out in a machine. The cutting point is then removed by driving a tool into the wedge-shaped cavity between it and the end wall of the groove and forcing the point out of the groove. If necessary the holder may be heated before driving out the cutting point.

Specially Equipped Grinding Machine

The Ransom Mfg. Company, Oshkosh, Wis., has recently provided special equipment for its motor-driven machine mounting two 18-in. emery wheels. This in-



A Two-Wheel Motor-Driven Grinding Machine Having a Foot Treadle Control for the Main Switch

cludes a foot treadle for starting and stopping the machine and glass eye shields on the wheel guards.

In shops where grinding is done either occasionally or intermittently, it is pointed out that workmen often allow a machine to run continuously instead of shutting it off when they have finished grinding. The addition of the foot treadle is designed to correct this condition and reduce the power consumption, as it is necessary for the operator to put his foot on the treadle before the machine will start and as soon as pressure is removed the machine stops automatically. A single-pole switch is thrown in when the foot treadle is depressed and the wheel is brought up to speed by an automatic accelerating starter.

The guards used around the wheels are of the builder's style D which was illustrated in THE IRON AGE, Feb. 10, 1916. They are made of tank steel with the exception of the nut guard at the side, the exhaust pipe connection at the back and the adjustable trap at the top, these parts being steel castings. In addition a glass shield for the eyes is attached to the adjustable trap at the top to protect the workmen against sparks and flying particles. The heavier particles from the grinding wheel are caught in a box at the bottom, which it is pointed out eliminates chance of the exhaust pipe becoming clogged. The outer plate is hinged to permit the wheels to be changed or the accumulation of sediment from the box at the bottom to be removed easily.

SENATE'S BROAD ARMY BILL

Enlarged Opportunity Given War Department to Contract for Arms and Ammunition

WASHINGTON, D. C., Aug. 1, 1916.—If the House concurs in sweeping changes made by the Senate in the army appropriation bill just passed by that body, the War Department will be able to use a much freer hand in the purchase of arms and ammunition than under existing law and will be able to give a greater measure of encouragement to private manufacturers desiring to equip their plants for the production of war material made to United States Army standards.

The army appropriation bill as passed by the Senate carries \$313,973,000, an increase of no less than \$131,000,000 in the measure as it passed the House and of \$212,000,000 as compared with the appropriations for the fiscal year ended June 30, 1916. The total defense budget, including the army, navy, fortifications, military academy and army and navy deficiency bills, has now been brought up to the huge sum of \$685,343,000.

The appropriation of \$4,500,000 made by the House for the manufacture of ammunition for small arms was increased by the Senate to \$12,776,000. The House provision that not more than \$2,000,000 of this appropriation might be used in the purchase of ammunition was stricken out by the Senate, leaving the entire sum available for that purpose, subject to the proviso that "the Government shall manufacture at its arsenals as much of said ammunition as can be produced by the exercise of the greatest economy and efficiency."

THE PROVISION FOR EDUCATIONAL ORDERS

Under this appropriation the Senate retained the House provision setting aside \$250,000 to procure "gages, dies, jigs, tools, fixtures and other special aids and appliances, including specifications and detail drawings, necessary for the manufacture by the Government and by private manufacturers of ammunition," but added an amendment giving the Secretary of War full discretion in the matter of the placing of so-called educational orders to concerns in whose plants special equipment has been installed. This amendment provides that "in the expenditure of this sum, the existing laws prescribing competition in the procurement of supplies by purchase shall not govern in orders not to exceed \$50,000 in any one case and in the purchase of lots of ammunition to complete the object of this proviso."

In connection with the appropriation for "manufacturing, repairing, procuring and issuing arms at the national armories" the bill as passed by the Senate also provides that \$200,000 of the \$2,500,000 appropriated may be used for the equipment of private concerns to manufacture such arms, and in this connection it is also provided that the requirement that contracts shall go only to the lowest bidder need not apply as to orders not exceeding \$50,000 in any one case.

INCREASED APPROPRIATION FOR FIELD ARTILLERY

The Senate Committee on Military Affairs, being greatly impressed by the lessons of the European war as to the necessity for large increases in the amount of field artillery available for the arming of the National Guard, increased the House appropriation of \$8,000,000 for this purpose to \$14,200,000 and also raised the amount available for the purchase of field guns from private manufacturers from \$4,000,000 to \$11,200,000. The Senate was equally liberal in providing for a supply of ammunition for field artillery for the National Guard, increasing the House appropriation from \$8,000,000 to \$14,000,000 and raising the amount available for purchasing ammunition from private manufacturers from \$4,000,000 to \$8,000,000. In this connection also the Senate provided that \$200,000 may be used for purchasing special equipment for private plants with competition waived as to orders not exceeding \$50,000 each.

There will doubtless be speculation as to the construction that will be placed by the War Department upon the proviso attached to the appropriations for arms and ammunition that the Government shall manufacture at its arsenals as much as can be produced "by

exercise of the greatest economy and efficiency." Obviously, great latitude is permitted the executive officers and there will be much opportunity for the exercise of judgment and discretion. Whether the restriction as to economical production is to be construed actually or relatively as compared with purchases made by contract or in the open market is an interesting phase of the subject. In any event, however, the War Department is no longer bound by hard and fast rules, and the officials of the Ordnance Bureau may safely be trusted to exercise an intelligent discretion in the matter.

W. L. C.

Progress in the Industrial Preparedness Inventory

More than 30,000 manufacturing concerns in the United States doing a business of over \$100,000 a year are being inventoried by the Committee on Industrial Preparedness of the United States Naval Consulting Board, to say nothing of many smaller plants with equipment peculiarly suited to turn out material for the fighting line. The committee reports that its carefully worked out plans to teach American manufacturers now, in time of peace, through annual educational orders, how to turn out war munitions and all other military and naval supplies when needed, will be incorporated into law. It likewise seems probable, it says, that legislation will soon be passed adopting the committee's measure for an industrial reserve, so that in time of war the skilled mechanic shall be kept at home on the job where his services are most needed to feed the firing line.

This legislation comes during the closing days of the committee's three-month campaign, made with a volunteer, unpaid organization of business men and engineers. Although the industrial inventory had been making excellent progress, national conditions recently became such that Chairman Howard E. Coffin sent urgent telegrams to the chairmen of the committee's State boards directing them to make all possible haste to gather the industrial information. At the same time Secretary of War Baker detailed five officers of the regular army service, two of them members of the general staff, to the committee's offices in the Engineering Societies Building, New York, to assist in rushing the work to the limit and to gain immediate benefit for the Government of the large amount of data already obtained.

Only a few business men have refused to give the desired information, usually to yield on a fuller explanation of the committee's purpose and the country's need. Reports from the State boards serving the main committee include the following noteworthy items:

An indication of how the inventory may create new industries is the opinion of Florida experts that while charcoal is not manufactured to any extent in the State considerable quantities could be produced in the time of great demand.

In Chicago there are more than 500 chemical and metallurgical plants to be studied. For added speed in securing the inventory for Illinois, engineering experts are working in conjunction with the Chicago Association of Commerce and the Illinois Manufacturers Association. Things are in good shape there. The chairman is Frederick K. Copeland, president Sullivan Machinery Company.

Indiana's canning plants could supply all the canned food that would be required to feed an army of any size that the United States might ever have to put in the field.

In the great agricultural State of Iowa a surprisingly large number of industrial plants, including railroad shops, has been inventoried.

The board of Nebraska has discovered a railway-motor manufacturing company that could transform its equipment to turn out 1000 high-explosive shells a day and could make guns if necessary.

In New York State it was even recently discovered that a silversmith is making thousands of cartridge cases a day for the 75-mm. guns, and caps for small arm cartridges and bullet jackets at the rate of several million a week. This firm is also equipped to produce complete lines of ammunition for field guns.

ESTABLISHED 1855

THE IRON AGE

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Published Every Thursday by the DAVID WILLIAMS CO., 239 West Thirty-ninth Street, New York

W. H. Taylor, *Pres. and Treas.*

Charles G. Phillips, *Vice-Pres.*

Fritz J. Frank, *Secretary*

M. C. Robbins, *Gen. Mgr.*

BRANCH OFFICES—Chicago: Otis Building. Pittsburgh: Park Building. Boston: Equitable Building. Philadelphia: Real Estate Trust Building. Cleveland: New England Building. Cincinnati: Mercantile Library Building.

Subscription Price: United States and Mexico, \$5.00 per year; single copy, 20 cents; to Canada, \$7.50 per year; to other foreign countries, \$10.00 per year. Entered at the New York Post Office as Second-class Mail Matter.

The Eastern Steel Trade's New Era

American steel manufacturers are too busy meeting the war's demands to take serious account of the changes war conditions have already made in the alignment of the competitive factors in the home industry. There will be much to say under this head when peace comes and the steel trade attempts to find itself, in the recasting of the lines of domestic and international competition. One phase of the transition may be referred to now, however, as among the changes whose significance is apt to be passed by, in all the engrossment of unparalleled sales and profits. It is the new place the Eastern steel industry has taken as the result of the two mergers of the past nine months.

For years the possibilities of a greater steel industry on the Atlantic seaboard or in the territory immediately tributary thereto have been discussed. More than one project has been promoted, based on Eastern magnetites and imported ores, with the outlet on the one hand of a home trade in vessel, structural and railroad steel, and a variety of wants of Eastern metal-working industries, and on the other hand of an export trade having the advantage over Pittsburgh of eliminating the long rail haul to the sea and expensive lighterage. Now and then the way seemed opening for the realization of some of these plans. But the Sparrows Point enterprise, for which much was hoped, was not an encouragement to further investment, and the Staten Island steel works ended in receivership; though neither of these, for reasons apart from location, was representative of the seaboard possibilities.

Less than a year of highly profitable export and domestic business and two or three rapid moves in the consolidation of important interests have set two strong companies far on the way toward realizing the long deferred hope for the steel industry of the East. The one, with a \$30,000,000 program of new plant at tidewater, to be built largely out of the profits of war contracts, looks to a permanent export trade in a variety of steel products, including rails, bars, plates, tin plates and wire, and to a large share in the development of American shipping, while its inland plants have a still greater career ahead in railroad, structural, ordnance and specialty lines. The other, with important bases in Government, shipyard, railroad equipment and specialty work for its two Eastern steel plants, is now engrossed with munitions orders, and having be-

sides the most profitable line in domestic trade, with early delivery plates at 3.50c. to 4c. a pound, is rapidly adding to its resources. Its plants west of the Alleghenies and its large holdings of Lake ore give it a position in the Central West—the best steel consuming district in the country—which strongly reinforces its seaboard and near-seaboard undertakings. A second year of war trade and of home prices made by the war promises to make both companies so strong in resources as to insure a commanding position in the Eastern steel trade for years to come.

It thus comes about that the European war has done more in a year to bring in the long looked-for new day of the Eastern steel trade than twenty-five years of promotions and theoretical discussions of the Atlantic seaboard's advantages as a future situs of profitable steel-making.

Trade After the War

It is a very impressive fact that the Allies have been getting together to make plans and agreements as to what they will do commercially after the war. It is quite unusual for a country to determine that when the war with its enemy is finished and a peace treaty is signed it will not trade with its former enemy. If the Allies feel that way, it is an enterprising thing to complete their agreements with each other while the war is at its height, for to take up such matters at a time when peace negotiations are in progress would be embarrassing all around, and to attempt to formulate arrangements after peace had been declared would be to invite the most serious difficulties among the Allies and with their former enemies.

These negotiations are strongly suggestive of the great trade awakening that should make very active business after the war. There are two other important facts that indicate great commercial activity after the war, facts that do not always seem to be given their full weight in the many discussions of after-the-war conditions.

One of these facts is that for many years prior to the war it was generally recognized that business would be better if there were no war cloud hanging over Europe. While nearly everyone was startled by the explosion, it was far from being something that had not been referred to as a distinct possibility, and that not for one or two years but for many years. The fear of a European war was al-

most an incubus, and now that incubus is removed, so that at length business will have an added tendency to expand.

The other fact to which attention should be directed is that one of the proximate causes of the war was the expansion the Allies, and particularly Russia, were undertaking. That was one of the things that kept Germany so on the alert. Thus the present plans for commerce after the war are not entirely new, but had their origin before the war started, and this fact gives the matter so much the greater weight.

The plans of Russia before the war were not well advertised by any means, and, of course, information is now held back as much as possible. It may be recalled, however, that the project to furnish Russia with an Arctic port open all the year round was undertaken well before the war started. Archangel becomes ice-bound by winds at certain times massing the ice. Five hundred miles to the west is the harbor of Ekaterinenhaven, open the year round because the Gulf Stream penetrates to its vicinity, and the building of a connection between this harbor and Petrograd, some 800 miles, was undertaken before the war, a short stretch by private capital and the major part by the government. The Russian demand for rails indicates that this is but one of several projects, including probably a completion of the double tracking of the Trans-Siberian railroad, but precise information as to these other projects is lacking.

Our exports of rails to Russia furnish concrete information of no small value. These exports, in gross tons, have been as follows:

	Russia in Europe	Russia in Asia
Last half, 1915	82,509	117,386
January, 1916	4,653	19,136
February	9,963	4,596
March	9,076	6,315
April	8,280	857
May	0	8,901
Eleven months	114,481	157,192
To both Russias		271,673

It may be surmised that the shipments to Russia in Asia are entirely for the Trans-Siberian, but of course this is not certain. The latest rail orders placed by Russia are chiefly for a section of 67½ pounds, which would run 106 tons to the mile, so that the shipments to Russia in Europe in the 11 months ending May might represent 1080 miles of track. Estimates made late last year ranged about 335,000 tons for the rails bought by Russia in the United States during the year, which would indicate that with 271,673 tons shipped up to June, and additional orders placed lately, there is still due Russia about 400,000 tons of rails, enough for perhaps 4000 miles of track in addition. Only a relatively small fraction of the rails purchased can be assumed to be for direct prosecution of the war.

Russia had many other ambitious projects, as is suggested by the fact that before the war there had already been undertaken a complete water supply and complete sewerage system for Petrograd, to cost in the neighborhood of \$100,000,000, while a union station was planned for Moscow, the nine roads reaching to the city having thus far extended

only to the outer line of the fortifications, from 2½ to 4 miles from the center of the city.

Thus, with the plans undertaken before the war, the removal of the war incubus, and the fresh plans developed during the war, there is a cumulative influence in the direction of trade activity after the war. That Russia is able to finance railroad building during the war strongly suggests that the financing of new projects after the war will not be as difficult as has been feared in some quarters.

Figuring Burden in Future Costs

Overhead costs were never a more uncertain factor than at the present time. The manufacturer's books tell him just what they amount to and also their exact relation to productive labor, process hours, machine hours or whatever other basis he may employ in apportioning burden in the cost of his products. But the figures apply with accuracy only to work actually done to date. The cost of a product cannot be determined until it is completed.

Therefore, in considering the future everything must be more or less of an estimate, no matter how detailed and exact the system of cost keeping. And in the estimate overhead must be considered as a variable whose ratio to the base may increase or decrease in a large way and possibly with astonishing suddenness. At present the percentage to be added to productive labor cost or to any other base is very low, in spite of the high price of labor, because the volume of business is so large that the distribution of burden is a broad one. Probably about low level has been reached.

How alterations in business conditions affect the overhead percentage, and consequently the cost of a product, may be illustrated by the supposititious case of a machine tool, the figures being close enough to the actual to preclude exaggeration. In the works where the machine is manufactured the total productive labor cost of the department two years ago was \$50,000, and the total overhead apportioned it was \$60,000, giving an overhead percentage of 120. The books at the present time show a total labor cost of \$100,000 and an overhead of \$75,000, or 75 per cent. Two years ago the productive labor cost of the machine was \$200; the added 120 per cent made a total cost, excluding material, of \$440. To-day the productive labor cost of the same machine is \$240, and the added overhead of 75 per cent brings the figure to \$420. In spite of the increased cost of labor and the increased total of overhead, the actual cost of the machine without material is less than it was before business became good. This condition is true of many products, because manufacturing is on so large a scale. In one comparatively small works building machine tools overhead has dropped from 120 to 65 per cent.

On the other hand, it takes no great drop in the volume of business to increase the overhead percentage and the cost of the machine. Supposing the total productive labor drops to \$70,000 because men have been laid off, business having let up somewhat, and at the same time total overhead falls to \$70,000 likewise. The latter item is more gradual in its shrinking always. The overhead percentage

thus jumps to 100. The labor cost of the machine does not decrease immediately; men may be dismissed, but it takes time to procure a reduction in the wages of employees as individuals. Consequently the cost of the machine increases from \$420 to \$480, a pretty serious advance.

The above goes to show that in looking to the future some safer estimate of overhead than the prevailing figure is necessary. Some firms strike an average of the percentages covering a period of years and, to get at a cost upon which to base a price, add this to an estimate of productive labor and material. Then, if business lets up before the product is ready for the customer, it is reasonably certain that no error has been made on the wrong side. To use this higher percentage naturally results in higher prices; but when conditions are such as to make this sort of figuring necessary, customers are not complaining very much about what they have to pay.

Canadian Car & Foundry Meeting

At the recent annual meeting of the Canadian Car & Foundry Company, Ltd., held in Montreal, President Nathaniel Curry said that the profits of the company and its subsidiaries for the first nine months of the present fiscal year amounted to \$1,178,353. After taking off \$298,000 for depreciation and renewals and \$480,717 for bond interest, the net earnings were \$398,742, which more than takes care of the preferred dividend. In addition to the \$298,000 written off for depreciation, \$600,000, the purchase price of new machinery, was written off. This was on home business, irrespective of Russian business.

Bringing the business up to date, President Curry reported that on July 22 unfilled orders on the books of the company amounted to \$12,664,000. Of this total \$4,281,000 is held by the Canadian Steel Foundries and the balance by the Car Company. Of the total orders \$6,949,545 is regular car business. The Canadian Steel Foundries has an order of \$3,202,000 for munitions.

Regarding home business, he said that it was the best in two years. Many of the railroads were already buying cars and must soon be in the market for more. Explaining the export car business, he stated that some of this had to be completed at a loss. It was new business that had to be learned, but was going along nicely now. He contended that, though the company had earned its preferred dividend this year, it would be impossible to resume payments until it had got back the \$3,500,000 expended on Russian business. There might, he thought, be some hope of a dividend in January.

New Company to Make Steam Turbines

The Moore Steam Turbine Corporation, Wellsville, N. Y., has been organized with an authorized capital stock of \$160,000 to build single and multi-stage steam turbines from 5 to 1000 hp. J. L. Moore, formerly chief engineer of the Kerr Turbine Company, is president; J. B. Laird is vice-president and E. D. Spicer is secretary and treasurer. The officers were formerly connected with the staff of the same company. Plans have been drawn and the contract will be let for a two-story reinforced concrete factory, 80 x 100 ft.

Chester Shipbuilding Company Expanding

The Chester Shipbuilding Company, Chester, Pa., operating what was formerly the John Roach shipyard, is reported to have bought the nearby property in Chester on which the Duplex Metals Company's plant is situated. It is on the Delaware River and has a frontage along the Reading Railroad of 560 ft. Since the Duplex Metal Company closed down, over a year ago, the plant has been used for storage purposes. The shipbuilding company will launch its first vessel early in August.

INSTITUTE OF METALS

Papers for the Cleveland Convention—Exhibition Space Much More Than in 1915

The tentative program for the annual meeting of the American Institute of Metals at Cleveland, Sept. 11-15, in connection with the convention of the American Foundrymen's Association, has been compiled by the secretary, W. M. Corse, and contains the following papers:

"Reclamation of Metallics from the By-Products of Foundry and Manufacturing Plants," by A. F. Taggart, Hammond Laboratory, Yale University, New Haven, Conn.

"Method of Selling Non-Ferrous Scrap, as Pursued by a Large Producer," by J. M. Bateman, Western Electric Company, Cleveland.

"The Result of Joint Work of Casting and Testing the 88-10-2 Alloy by Five Foundries, Report of the Use of the Deoxidizers of Bronzes and Report on the Aspects of Bronze Failures," by various experts affiliated with the U. S. Bureau of Standards, Washington, D. C.

"Copper-Aluminum-Iron Alloys," by W. M. Corse, Titanium Alloy Mfg. Company, Niagara Falls, N. Y.

"Tests on Rolled Brass Sheets Taken in the Direction of Rolling and at Right Angles to the Direction," by W. B. Price and P. H. Davidson, Scovill Mfg. Company, Waterbury, Conn.

"The Application of Oxy-Acetylene Welding Process in the Repair of Defective Non-Ferrous Castings," by S. W. Miller, Rochester Welding Company, Rochester, N. Y.

"Continuation of Discussion in Connection with Defective Bronze Castings in Use by the Board of Water Supply of New York City," by A. D. Flinn, Board of Water Supply, New York.

"Evolution of Die Casting Process," by Charles Pack, Doehler Die Casting Company, Brooklyn, N. Y.

"Disclosure of Blowholes by Means of X-Ray Apparatus," to be reported by testing engineers employed in laboratory D of the General Electric Company, Schenectady, N. Y.

"Aluminum Castings and Forgings," by P. E. McKinney, U. S. Navy Yard, Washington, D. C.

"Annealing Properties of Copper," by G. W. Ceaser and G. C. Gerner, Hammond Laboratory, Yale University, New Haven, Conn.

"Metallography as Applied to Non-Ferrous Metals," by W. W. Arthur, Frankford Arsenal, Frankford, Philadelphia.

"Heat Treatment of German Silver," by G. C. Holder, American Optical Company.

S. D. Sleeth of the Westinghouse Air Brake Company, Wilmerding, Pa., and Mr. Barnes of the Fort Wayne Electric Company, Fort Wayne, Ind., will present papers at the session which is to be devoted exclusively to the discussion of brass foundry practice, and papers also will be read by F. L. Antisell, Raritan Copper Works, Perth Amboy, N. J., and by Mr. Bragg, Ohio Brass Company, Mansfield, Ohio.

The managers of the foundry exhibition, which will be held in the Coliseum at Cleveland in the week of the foundrymen's conventions, state that 50 per cent more space has been sold already than was taken at the Atlantic City exhibition of last year. A temporary building will be erected opposite the Coliseum which will afford 10,000 sq. ft. additional floor space.

A meeting of the Cleveland reception, entertainment and plant visitation committees was held at the Hollenden Hotel on Thursday, July 27, and the principal entertainment features were then announced. There will be a trip to the ball park Tuesday afternoon, Sept. 12, for the game between Cleveland and Detroit; a trip to Euclid Beach Park Tuesday evening in special cars, tickets being furnished to all concessions; an inspection trip Wednesday afternoon to the Cleveland Furnace Company's blast-burnace plant on the Cuyahoga River flats, and entertainment at Keith's Hippodrome Wednesday evening. A luncheon will be given the ladies at the Hotel Statler and on a later day an automobile ride. The annual banquet will be held Thursday evening at the Statler, with Irving Bacheller as one of the speakers. Plant visitation will be limited to Thursday and Friday. Arrangements have been made thus far for the inspection of the plants of the Ferro Machine & Foundry Company, Allyne-Ryan Foundry Company and Westinghouse Electric & Mfg. Company.

Senate Puts Its Stamp on Inefficiency

Grotesque Ignorance Concerning the Purpose and Method of Time Studies —Labor Union Orders Again Obeyed

WASHINGTON, D. C. AUGUST 1, 1916.—Pursuant to the understanding reached a fortnight ago, the final chapter in the farcical performance by which Congress will deprive all Government establishments of the right to employ efficiency systems was enacted in the Senate on July 26 when, by a vote of 36 to 15, 44 Senators not voting, an amendment drafted by the Committee on Military Affairs striking out the House provision prohibiting the use of scientific shop management in Government factories was rejected. There have been many disgusting exhibitions of ignorance as to what constitutes scientific management, since this important question first came before Congress, but the debate in the Senate on the army bill just concluded bears off the palm, not only for utter lack of accurate information on the part of the opponents of efficiency, but for reckless misstatement of every important fact in connection therewith.

Whatever opportunities to handicap the manufacturing establishments of the Government the labor leaders may have overlooked a year ago, when they failed to secure the complete prohibition of efficiency systems in the arsenals, they have done a very comprehensive job in the present session. Specific prohibitions against the use of any time-measuring device and against the payment of bonuses or premiums have been incorporated in the Army, Navy and Fortifications appropriation bills, which provide the funds for the support of the entire military establishment of the Government, and also in the Sundry Civil appropriation bill from which are paid the salaries and wages of all civilian employees engaged in any form of manual labor. Thus, at a time when the Government is facing the most serious emergency it has confronted in half a century, Congress has deprived it of every means of developing the efficiency of those branches of the public service upon which the safety and general welfare of the country depend.

EGREGIOUS IGNORANCE OR WORSE

In deference to the unanswerable arguments presented by General Crozier, chief of the Ordnance Bureau of the War Department, the Senate military committee reported an amendment to the army bill striking out the provision adopted in the House prohibiting efficiency systems in the arsenals. This action of the committee was sharply assailed on the floor by Senator Martine of New Jersey. A fair illustration of the gross misrepresentation employed by the opponents of scientific management in Congress is found in the following extract from Senator Martine's remarks:

Of course, we cannot prevent the installation and operation of such systems in private institutions, in mills and plants operated by private parties, but to me the whole thought is so barbarous that in my opinion our Government should have no connection with it, but should spurn it and drive it out of every plant under its control. I refer to the system known as the Taylor system.

Mr. Taylor, I believe, at one time was a laborer. He found it wise, for purposes of his own or for the profit of his employer, to inaugurate the so-called Taylor system, which is a time-watch system. We can all tolerate—I can. I know—a time watch being held over a race horse to find out what he may accomplish in a given time; but to have an officer of the Government hold such a watch over a workman in the employ of the Government, a workman who is doing his honest best for his employer, I feel is most humiliating and belittling and contrary to the spirit of American institutions.

I do not believe that the God of humanity breathed the breath of life into man that he should live to work, but that he should work in order to live, and there is a very wide difference between the two.

Continuing, Senator Martine declared that an em-

ployee of the Post Office Department had been "placed under a time watch and driven on to see how much he could accomplish" until he "suffered a mental collapse and was taken to the asylum"; but upon being questioned by his colleagues, the Senator admitted that he did not know the name of the man referred to nor could he state where he was employed.

SANITY AND TRUTH

The chief defender of efficiency systems in the debate on the army bill was Senator Weeks of Massachusetts, who lives within a few miles of the Watertown Arsenal and is thoroughly familiar with the operation of scientific management in that institution. Senator Weeks sharply assailed Senator Martine's description of efficiency systems, declaring that if the picture drawn were accurate there would not be a vote in the Senate in favor of continuing such methods. Senator Weeks explained that the time study was limited to the planning room and that the picture drawn by opponents of efficiency systems of men laboring breathlessly under a stop-watch held by an overseer was purely imaginative. Continuing, he said:

I went through the Ford shops in Detroit not very long ago. They are a marvel of industrial efficiency. I should say. There was one thing particularly which I noticed; that is, that most of the men, or very many of the men, stood at a machine and simply started and stopped it. They did not have to change their positions in any way. The operation was so developed that a man did one thing, and generally he did not have to move more than a foot or two in order to do that thing, especially when they came to assemble the parts of the cars; the material never stopped from the time it was placed on a traveling sidewalk, as you might call it, until somebody jumped into the seat of the car and off it went under its own power. Everything was so systematized that there was not a lost motion, and I should say there is not a lost motion in that manufacturing establishment. This arrangement makes a tremendous saving in the cost of manufacture; that is exactly what the people at the Watertown Arsenal, and I think now at one or two other arsenals, have undertaken to do in behalf of the Government.

INEFFICIENCY AT A TIME OF CRISIS

After paying a tribute to Mr. Taylor's work as a pioneer in the establishment of efficiency systems, Senator Weeks declared that the country was now facing a crisis which could only be satisfactorily met by the development of efficiency in every possible direction. He said:

Now, what kind of a position are we going to be in when this European war is over. Mr. President, if we are to say to our people, "You shall not adopt efficient methods"? We know that Germany, for example, has developed itself and its people enormously because they have done just that thing. At the end of the war we are going to see millions of thoroughly trained men return to industrial pursuits, in addition to the competition which we are meeting today; and I believe that if the very leaders in labor circles who are in favor of this general legislation known as the Tavenner bill would take into consideration the broad problem of competition with European workmen they themselves would be in favor of the adoption of this system as it has been carried out at Watertown.

Senator Weeks quoted from letters in support of scientific management in Government establishments recently written by Elmer A. Sperry and Frank J. Sprague, members of Secretary Daniels's Naval Consulting Board, and placed in the record a large number of communications from manufacturers in a dozen different industries and from employees in Government and private establishments where scientific management is in use.

Senator Reed of Missouri spoke at length against scientific management, disclosing abject ignorance as

to its practical operation as will be gathered from this extract from his remarks:

In order to determine what a workman is doing, as I understand the system—and I speak of it in the rough—if the expert has determined that a certain job ought to be done in 50 minutes, when a workman starts at that job the stop watch is started, and when it has run the 50 minutes the stop watch stops. If it takes the workman an hour longer to complete the job, he gets no pay for that additional hour; but if he gets through with his job in 40 minutes, he not only gets the price he would receive if he did it in 50 minutes, but he gets an additional price. So that the premium is put upon speed—not upon the care or skill with which the work is done. If it be up to a standard sufficient to pass at all, a premium is put upon speed.

A strong appeal to the Senate not to discredit the Government and the Senate itself by assaults upon efficiency methods was made by Senator Thomas of Colorado, who said in part:

We must, legislation or no legislation, recognize the right of a man who possesses faculties superior to those of his fellows to enjoy the benefit of them in any system, regardless of what his calling may be. We recognize the right in every other department of life. We send our children to school and spur the ambition of each to exceed his fellows. Every system that will hold the ambitious down to the level of his less fortunate fellows will be repudiated by the common sense of every thinking man and woman in the country. The same is true in the professions; the same is true everywhere; and it will always be true, regardless of human legislation, as long as time shall run. There is no equality in nature; there is no equality of physical and mental endowment among men.

What is efficiency, Mr. President? One homely definition would be, the best way of doing things. I understand it is the purpose of the Government to follow that method of procedure which will enable it to ascertain the best way of doing things, so that it can compete with those great private institutions engaged in the manufacture of the articles which the Government proposes to make for itself, and just in proportion as we place handicaps on the Government just in that proportion will its attempt to compete with private institutions fail, and the Government manufacture will be a failure because of the contrast that its cost of production will present to that high state of efficiency prevailing in private circles and to which no just complaint can be made.

Upon the conclusion of Senator Thomas's remarks the vote was taken, resulting in the rejection of the committee amendment and leaving the prohibition of efficiency systems as adopted by the House in full force and effect.

W. L. C.

RECORD TUNGSTEN ORE OUTPUT

The United States Now the Largest Producer—Imports and Consumption

The tungsten production of the United States in the first six months of 1916 exceeded the production of this or any other country in any previous twelve months. Prices were even more phenomenal, reaching more than ten times their ordinary level. The output was equivalent to about 3290 net tons of concentrates carrying 60 per cent WO₃, valued at \$9,113,000, according to an estimate by Frank L. Hess of the U. S. Geological Survey. These figures are no less noteworthy when it is known that in 1915 much the larger part of the production was in the second half of the year, so that the total domestic output for the twelve months ended June 30, 1916, probably amounted to about 5000 tons.

Colorado has regained its lead in the production of these ores, and between Jan. 1 and June 30 marketed 1505 tons, valued at \$3,638,000, of which the Boulder field furnished 1494 tons. California sold 984 tons. From Nevada 461 tons and from Arizona 175 tons are estimated to have been shipped. The quantities and values were approximately as follows: Ferberite, 1495 tons, \$3,590,000; scheelite, 1404 tons, \$4,322,000; wolframite, 201 tons, \$613,000; and hübnerite, 185 tons, \$587,000. In most countries the prevailing mineral is wolframite, and no other country approaches the United States in the quantity of ferberite or scheelite produced. The scheelite comes mostly from Atolia, Cal., but sig-

nificant quantities are mined in Nevada, Arizona, Idaho and Connecticut.

The tremendous increase of prices caused by the need for high speed tools, of course, caused the great increase in production. At the beginning of the year ores carrying 60 per cent tungsten trioxide brought as much as \$66 a unit, but by the last of March some ferberite sold for \$93.50 a unit at the mills. Under the stimulus of these high prices production, not only in this country but in the world at large, has been at the highest point ever known. It increased faster than the consumption and soon overran the demand that would absorb the output at the extremely high prices prevailing, so that a drop in prices was inevitable. June closed with the price around \$25 a unit, which was still much higher than any price known before this year. The highest price previously reported to the Geological Survey was \$15 a unit, paid in 1907. The normal price has been \$6 to \$7.

In the six months 40 mills of various types and sizes were in operation part or all of the time on tungsten ores, and at the end of June 14 were under construction. In the tungsten mining camps the excitement that followed the increase of prices was similar to that caused by important gold discoveries. Nederland, Col., a little village of two or three dozen homes, suddenly became a town of 3000 or more inhabitants. East of Nederland two settlements, each containing several hundred people, sprang into existence. Atolia, Cal., a camp of 60 or 80 people, grew to more than 1000.

In the Boulder region, Colorado, 10 mills, six of which were new, were in operation. Besides these, at the end of June five old mills were being overhauled to work on tungsten ores, and three new ones were under construction. In Arizona four mills were erected at Dragoon, three at Arivaca, and one at Yucca. In California two mills were reported under construction near Goffs and one near Nipton. At Atolia the mill of the Atolia Mining Company was burned, but was rebuilt and enlarged. In Nevada a mill was constructed and operated near Toy, Humboldt County, and four or more mills were constructed in the Snake range, in which tungsten deposits were found through a length of 50 miles.

The consumption of tungsten in the United States was even greater than was indicated by the ores produced, for all parts of the world free from the control of the warring European nations were drawn on for supplies, and during the first five months of the year 1520 tons of tungsten ore, valued at \$3,449,311, were imported. The June imports were probably equal to the average of the five preceding months, making a total for the half year of 1824 tons, valued at \$4,139,000. Most of the ore came from South America—Peru, Bolivia, Argentina and a little from Brazil—but some came from Japan and Mexico. Ten tons of tungsten metal and ferrotungsten, valued at \$36,885, were recorded as imported. The exports for the first five months of the year amounted to 4906 lb., valued at \$10,571.

If the American production and imports are added, the consumption seems to have amounted roughly to 5100 tons of 60 per cent concentrates, valued at \$13,278,000. On the supposition that 20 per cent of the metal was lost in various operations, it seems probable that between 11,000 and 12,000 tons of new high speed steels were made during the period, in addition to the steel made from tungsten saved from scrap and scale.

Record Exports of Locomotives

In the 11 months ended May 31, 1916, 740 locomotives were exported, as compared with 216 and 364 for the like periods in 1915 and 1914 respectively. In 1915 the total number exported was 621, against 269 in 1914 and 491 in 1913. Of the 740 sent abroad in the last 11 months, 209 went to Europe, 209 to Russia in Asia, 103 to Cuba, 39 to Canada and 36 to Mexico.

A wire drawing plant for its own use is being installed in the factory of the Williamsport Wire Rope Company, Williamsport, Pa., and it is expected to be in operation by Dec. 1.

Hydraulic System in Modern Shell Plant

(Continued from page 233)

10-ton Shaw electric traveling crane that serves the entire floor and are carried down the shop floor and set in front of the furnaces. The boxes have an eye on each corner and are picked up by means of chains and hooks attached to the crane. After the second heating and drawing operation the formed shells are piled on trucks and conveyed by the crane to the cooling space near the north or shipping end of the press room. After cooling they are loaded on trucks and are conveyed by the tractors out to the shipping platform and directly on the cars. A depressed railroad siding brings the car floors on a level with the shipping platform.

UNIQUE HEATING SYSTEM

The heating system is unique, being designed especially to meet the requirements of the plant. Underground ducts for heating were not wanted because of the cost and there was no place for over-head ducts, and as a result a unit system of forced air circulation through Vento heaters was provided, which is extremely flexible and is regarded as well adapted to a plant of this character, where the heating requirements are to a large extent localized; no service from the heating system is of course required in the section of the plant near the furnaces. However, it is stated that this system would not be practical in a plant where it is desired to operate blowers during the summer for ventilation.

There are twelve separate heating units, each composed of a 22-in. turbo under-grate type of blower and five sections of 40-in. regular Vento radiation, each section consisting of seven loops spaced on 5¼-in. centers, arranged horizontally. The coils are inclosed in a sheet steel jacket at the top of which is located a steam turbine and blower. The Vento coils are heated by exhaust steam from the turbine. Steam comes to the turbine through a 1-in. supply line at 100 lb. pressure. A by-pass connection is made from the steam supply line through a reducing valve to the coils so that in the extremely cold weather, when the exhaust steam from the turbine is not sufficient for the heating, the supply can be augmented by live steam. The return is collected into one pipe and the condensation is taken care of by the Webster vacuum return system. The heated air passes out through a diffuser just above the floor that splits it, sending it out horizontally in three directions along the floor.

The blower displaces 11,000 cu. ft. of air per minute running at a speed of 5000 r.p.m. A test showed that air entering the heater at 68½ deg. left the coils at 150 deg. with the blower running at 3139 r.p.m. The heating equipment was furnished by the B. F. Sturtevant Company.

The toilet room facilities are unusually complete. Both hot and cold water is supplied at the wash basins, and in addition to the usual toilet accommodations and steel lockers 12 showers are provided, equipped with Power thermo shower control, maintaining a temperature of 110 deg.

The Haskell & Barker Car Company, Michigan City, Ind., has set its clocks one hour ahead for the summer. Work begins at 5.45 a. m. and stops at 4.30 p. m.; noon spell, 11.45 to 12.30. The new schedule gives six hours for work in the morning and four in the afternoon, employees thus gaining an hour of daylight for themselves for the afternoon.

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Magnesite Imports and Prices

Despite freer conditions as to the importation of magnesite from Greece, quantities now being received are far below normal, and the operating difficulties of steel manufacturers are very considerable. The following table of Government data shows imports in pounds in

		Per Month
January to June, 1916, 5 months.....	11,309,472	2,261,894
Year, 1915	55,146,407	4,595,534
Year, 1914	241,165,822	20,097,151
Year, 1913	335,867,672	27,988,972

The present import rate of about 3,000,000 lb. per month is thus but a fraction of the importations of about 28,000,000 lb. per month in 1913. The greatest source before the war was Austria. Magnesite brick have advanced from about \$150 per 1000 before the war to \$600 and \$650 at present.

PIG-IRON PRODUCTION

A Further Falling Off in July

More Furnaces Go Out for Relining, Making a Net Loss of Six in the Month

By the special co-operation of the blast-furnace companies THE IRON AGE is able to send to press on Aug. 2 its pig-iron statistics for July. The total output of coke iron for the month, estimates being made for a few furnaces, was 3,229,819 tons, or 104,188 tons a day, against 3,211,588 tons in July, or 107,053 tons a day. Due to humidity, most furnaces fell short of their June rate and the number of furnaces compelled to blow out for relining is increasing. Thus July, with one day more, exceeded by only a small amount the output of the 30 days of June. Eleven furnaces were blown out last month and five were blown in, so that the number active on Aug. 1 was 319, with a daily capacity of 104,474 tons, against 325 active on July 1, with a daily capacity of 107,822 tons.

DAILY RATE OF PRODUCTION

The daily rate of production of coke and anthracite pig iron by months, from July, 1915, is as follows:

Daily Rate of Pig-Iron Production by Months—Gross Tons			
	Steel Works	Merchant	Total
July, 1915	62,895	19,796	82,691
August	67,801	21,865	89,666
September	70,977	24,108	95,085
October	73,595	27,227	100,822
November	73,282	27,962	101,244
December	73,647	29,686	103,333
January, 1916	72,614	30,132	102,746
February	75,305	31,151	106,456
March	76,274	31,393	107,667
April	77,226	30,366	107,592
May	77,706	30,716	108,422
June	76,526	30,527	107,053
July	74,360	29,728	104,088

OUTPUT BY DISTRICTS

The accompanying table gives the production of all coke and anthracite furnaces in July and the three months preceding:

Monthly Pig-Iron Production—Gross Tons				
	Apr. (30 days)	May (31 days)	June (30 days)	July (31 days)
New York	189,312	210,464	190,140	190,115
New Jersey	1,538	6,686	6,379	6,621
Lehigh Valley	112,210	117,870	111,689	104,835
Schuylkill Valley	90,753	94,254	93,552	89,311
Lower Susquehanna and Lebanon Valley	69,407	80,293	75,092	73,064
Pittsburgh district	752,068	750,903	728,071	736,652
Shenango Valley	191,700	195,867	172,259	178,903
Western Pennsylvania	165,790	167,913	157,909	169,412
Maryland, Virginia and Kentucky	90,584	94,302	85,687	89,967
Wheeling district	127,101	131,764	125,889	128,135
Mahoning Valley	309,045	324,739	315,675	314,461
Central and Northern Ohio	239,963	274,693	274,526	261,132
Hocking Valley and Hanging Rock	50,120	46,079	48,640	48,650
Chicago district	467,147	481,714	462,394	465,895
Mich., Minn., Mo., Wis. and Col.	119,634	127,278	123,116	120,985
Alabama	227,417	223,439	204,076	214,566
Tennessee	25,424	32,815	33,494	33,515
Total	3,227,768	3,361,073	3,211,588	3,226,719

PRODUCTION OF STEEL COMPANIES

Returns from all furnaces of the United States Steel Corporation and the various independent steel companies show the following totals of product month by month. Only steel-making iron is included in the figures below, together with ferromanganese and spiegeleisen. These last, while stated separately, are also included in the columns of "total production."

Production of Steel Companies—Gross Tons					
	Pig, total production			Spiegeleisen and ferromanganese	
	1914	1915	1916	1914	1915
Jan.	1,261,430	1,115,944	2,251,035	17,325	18,041
Feb.	1,329,414	1,237,380	2,183,845	10,524	13,319
Mar.	1,704,688	1,551,082	2,365,116	20,133	12,274
Apr.	1,635,226	1,584,111	2,316,768	18,676	12,337
May	1,457,847	1,694,290	2,408,890	21,504	13,440
June	1,329,623	1,770,657	2,295,784	16,254	19,200
July	1,395,851	1,949,750	2,305,148	16,524	17,854
Aug.	1,455,054	2,101,818	.....	11,577	27,463
Sept.	1,390,322	2,129,322	.....	13,786	23,159
Oct.	1,271,820	2,281,456	.....	17,435	23,992
Nov.	1,059,159	2,198,459	.....	21,977	28,741
Dec.	1,034,802	2,283,047	.....	20,733	25,004

CAPACITY IN BLAST AUGUST 1 AND JULY 1

The following table shows the daily capacity in gross tons of furnaces in blast August 1 and July 1 by districts:

Coke and Anthracite Furnaces in Blast					
Location of furnaces	Total number of stacks	Number in blast Aug. 1	Capacity per day Aug. 1	Number in blast July 1	Capacity per day July 1
New York:					
Buffalo	19	17	5,555	17	5,950
Other New York	5	3	578	3	590
New Jersey	6	1	214	1	213
Pennsylvania:					
Lehigh Valley	20	12	3,494	12	3,362
Spiegel	2	2	202	2	195
Schuylkill Val.	12	10	2,897	11	3,133
Lower Susquehanna	6	5	1,376	5	1,510
Lebanon Valley	8	7	911	7	1,003
Ferro and					
Spiegel	1	0	0	1	90
Pittsburgh Dist.	53	50	23,274	52	23,851
Ferro	3	3	306	2	372
Shenango Val.	19	18	5,771	19	5,942
Western Pa.	24	18	5,377	18	5,403
Ferro and					
Spiegel	3	1	108	1	103
Maryland	3	3	1,238	3	1,247
Ferro	1	1	104	1	108
Wheeling District	14	13	4,133	13	4,196
Ohio:					
Mahoning Val.	25	25	10,613	24	10,522
Central and Northern	24	21	8,425	23	9,154
Hock. Val. and Hanging Rock	15	11	1,608	11	1,657
Illinois and Ind.	35	30	14,666	32	15,425
Ferro	1	2	150	1	87
Michigan, Wis. & Minn.	12	10	2,603	11	2,952
Col. and Mo.	6	3	1,032	3	998
Ferro	1	1	169	1	153
The South:					
Virginia	18	9	1,070	8	989
Kentucky	5	4	498	4	558
Alabama	38	29	6,921	29	7,018
Tennessee	15	10	1,081	10	1,041
Total	394	319	104,374	325	107,822

THE RECORD OF PRODUCTION

Production of Coke and Anthracite Pig Iron in the United States by Months Since Jan. 1, 1912—Gross Tons

	1912	1913	1914	1915	1916
Jan.	2,057,911	2,795,331	1,885,054	1,601,421	3,185,121
Feb.	2,100,815	2,586,337	1,888,670	1,674,771	3,087,212
Mar.	2,405,318	2,763,563	2,347,867	2,063,834	3,337,691
Apr.	2,375,436	2,752,761	2,269,655	2,116,494	3,227,768
May	2,512,582	2,822,217	2,092,686	2,263,470	3,261,073
June	2,440,745	2,628,565	1,917,783	2,380,827	3,211,588
July	2,410,889	2,560,646	1,957,645	2,563,420	3,226,719
7 mo.	16,303,696	18,909,420	14,359,360	14,664,237	22,637,172

Aug.	2,512,431	2,545,763	1,995,261	2,779,647	.....
Sept.	2,463,839	2,505,927	1,882,577	2,852,561	.....
Oct.	2,689,933	2,546,261	1,778,186	3,125,491	.....
Nov.	2,630,854	2,283,123	1,518,316	3,037,308	.....
Dec.	2,782,737	1,983,607	1,515,752	3,203,322	.....

Total, yr. 29,383,490 30,724,101 23,049,752 29,662,566

DIAGRAM OF PIG-IRON PRODUCTION AND PRICES

The figures for daily average production, beginning January, 1909, are as follows:

Daily Average Production of Coke and Anthracite Pig Iron in the United States by Months Since Jan. 1, 1909—Gross Tons

	1909	1910	1911	1912	1913	1914	1915	1916
Jan.	57,975	84,148	56,752	66,384	90,172	60,808	51,659	102,746
Feb.	60,976	85,616	64,090	72,442	92,369	67,453	59,313	106,456
Mar.	59,232	84,459	70,036	77,591	89,147	75,738	66,575	107,667
Apr.	57,962	82,792	68,836	79,181	91,759	75,665	70,550	107,592
May	60,753	77,102	61,079	81,051	91,039	67,506	73,015	108,422
June	64,656	75,516	59,585	81,358	87,619	63,916	79,361	107,053
July	67,793	69,305	57,841	77,738	82,601	63,150	82,691	104,088
Aug.	72,546	67,963	62,150	81,046	82,057	64,363	89,666	.....
Sept.	79,507	68,476	65,903	82,128	83,531	62,753	95,085	.....
Oct.	83,856	67,520	67,811	86,722	82,133	57,361	100,822	.....
Nov.	84,917	63,659	66,648	87,697	74,453	50,611	101,244	.....
Dec.	85,022	57,349	65,912	89,766	63,987	48,896	103,333	.....

The fluctuations in pig-iron production from January, 1908, to the present time are shown in the accompanying chart. The figures represented by the heavy lines are those of daily average production, by months, of coke and anthracite iron. The two other curves on the chart represent monthly average prices of Southern No. 2 foundry pig iron at Cincinnati and of local No. 2 foundry iron at furnace at Chicago. They are based on the weekly market quotations of THE IRON AGE.

Among furnaces blown out in July were one Bethlehem and one Crane in the Lehigh valley, Delaware River in eastern Pennsylvania, one Colebrook in the Lebanon valley, one Eliza in the Pittsburgh district, Ella in the Shenango valley, one Central and one

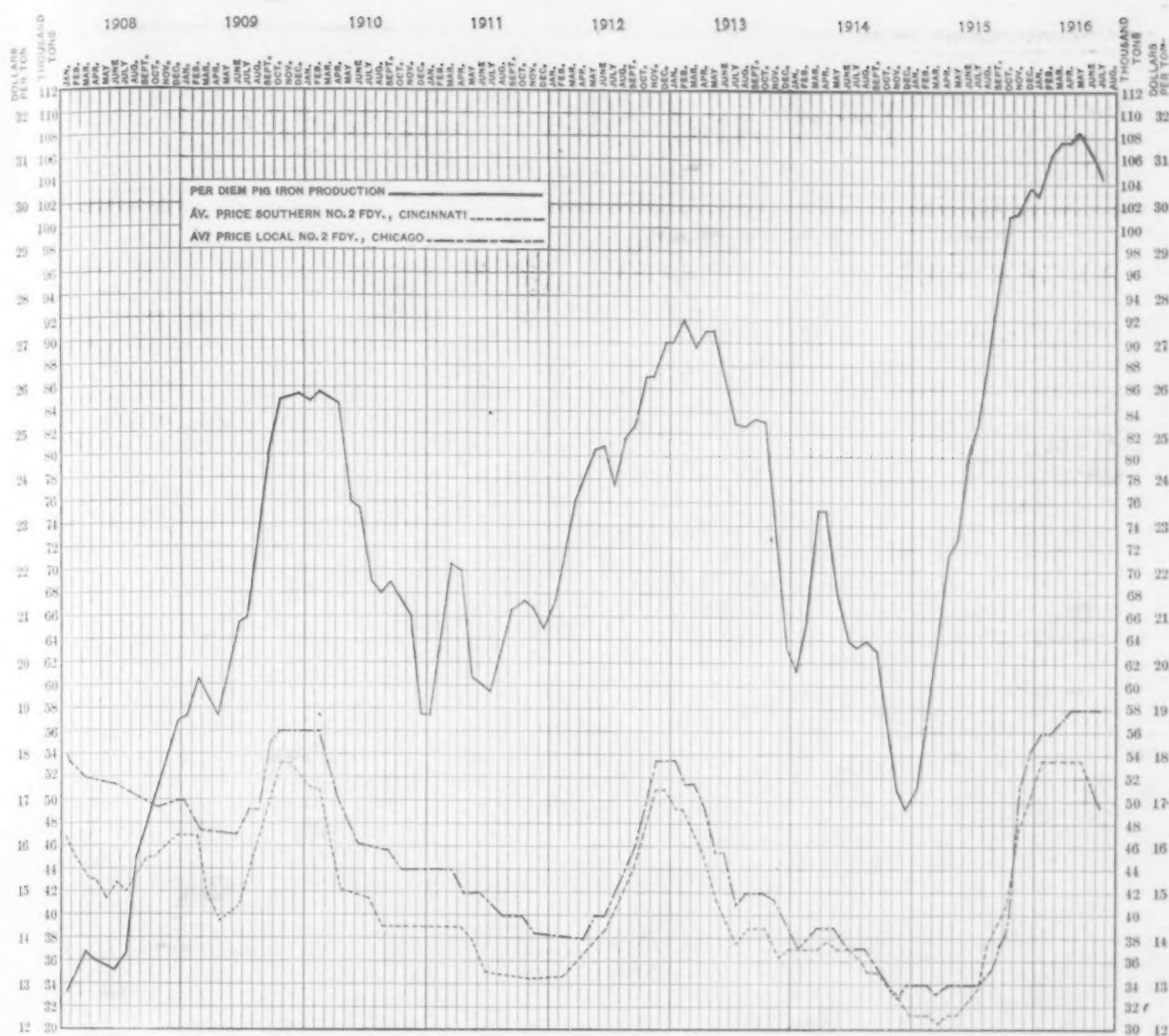


Diagram of Daily Average Production by Months of Coke and Anthracite Pig Iron in the United States from Jan. 1, 1908, to Aug. 1, 1916; Also of Monthly Average Prices of Southern No. 2 Foundry Iron at Cincinnati and Local No. 2 Foundry Iron at Chicago District Furnace

Columbus in Ohio, one South Chicago and one Gary in the Chicago district, one Bay View in Wisconsin.

The list of furnaces blown in last month includes Crumwold and Macungie in the Lehigh valley, Buena Vista in Virginia, Struthers in the Mahoning valley, and one South Chicago in the Chicago district.

Blast Furnace Operations

No. 2 furnace of the Wellston Iron Furnace Company, the larger of the company's two stacks at Wellston, Ohio, was scheduled to blow in on Aug. 3.

The furnace of the Bessie Furnace Company at New Straitsville, Ohio, was blown out July 11 for relining and for repairs to stoves. Blast was put on again Aug. 1.

The old Union works blast furnaces of the Illinois Steel Company at Ashland Avenue and Thirty-first Street, Chicago, were dismantled in July. These two stacks were built in 1881 and were rebuilt in 1889. They were last active in 1910.

One of the Bethlehem Steel Company's furnaces at South Bethlehem, Pa., has been blown out for relining.

The Woodstock Operating Corporation will blow in next week the Anniston, Ala., furnace it has been preparing for operation after a long idleness.

The Adamant Iron & Steel Company, Kent, Ohio, has begun the manufacture of high-speed and standard tool steel from iron and low-grade steel. It is stated that the process used is the same as that followed in making a new tool steel in Sheffield, England, that was referred to on page 1527 of THE IRON AGE of June 22. The company's furnaces are located at the plant of the Cleveland Steel Valve Company in Kent.

Record-Breaking Lake Ore Shipments

CLEVELAND, OHIO, Aug. 2, 1916. (By Telegraph)—Iron-ore shipments from Lake Superior mines again broke records during July, when the movement reached 9,750,157 gross tons, or a gain of more than 200,000 tons over June. The total for the season to Aug. 1 is 29,365,724 tons, a gain of 5,036,265 tons over the corresponding period in the record-breaking season of 1913. If the rate of gain is kept up, this season's water shipments will easily exceed 60,000,000 tons.

Ferromanganese Imports Above Normal

Ferromanganese imports in June, from Government data furnished THE IRON AGE, were 12,124 gross tons, the largest for this year or for any month since the war started. Imports in May were 8466 tons, and for the first five months, 46,488 tons. This is at the rate of 111,564 tons per year, which compares with only 55,201 tons for 1915 and 128,070 tons for 1913, the record year. The 5-yr. average (1910 to 1914) was 100,793 tons. The June imports were received as follows: Through Baltimore, 6471 tons; Philadelphia, 1910 tons; New York, 2998 tons; New Orleans, 595 tons; Norfolk, 150 tons.

The Iroquois Iron Company, Chicago, has purchased from the United States Smelting & Refining Company a large tract adjoining its present plant, which is a preliminary to the erection of another blast furnace. The construction of this stack will probably not be undertaken until more normal conditions and more normal costs of material are again in effect.

Iron and Steel Markets

LARGER EXPORT DEMAND

Home Prices Turn on Its Continuance

An Advance in Steel Bars—Pig-Iron Output Declines Further

The placing of additional contracts for large shells, deliveries in some cases running to July 1, 1917, is confirmed by negotiations for steel which have been actively under way in the past week. Apparently some of the companies taking shell orders have not yet covered in the steel market. Their requirements, added to steel which agents of the Allies are seeking to buy for the next nine or ten months, make a total estimated at 400,000 to 500,000 tons.

The effect on the situation, of war buying on a scale greater than was counted on a few months ago, is becoming the foremost issue in the domestic steel market. Consumers at home have relied on a waning munitions demand, the increase in steel-making capacity, and the cutting down of buying of certain steel products because of high prices, to work out lower prices for them when they came to buy for the late months of 1916 or the first half of 1917. There is, too, the factor of stocks in consumers' hands, due to the heavy specifying of many months, also the disappearance of the excited scramble for material that was marked six months ago.

Steel producers point not only to the large scale of the new buying for the Allies, but to the accumulating world demand for steel apart from war uses, which this country must satisfy if the war goes on another year or more.

In the face of the abstention of many consumers from the market and the active efforts of some for lower prices, as in the case of implement makers, the steel makers are less inclined to make concessions than in June and early July. On steel bars the Steel Corporation is understood to have advanced its price \$2 a ton this week, or to 2.60c. Pittsburgh. Sales of bars have been made in the past week, however, at 2.50c. for forward delivery and Bessemer bars have been available at that price for delivery in two months.

As the bar market has been the storm center in the contest for concessions, the effect of this latest move will be closely watched.

At Pittsburgh steel billets have shown greater strength, and there are no longer offerings at concessions as in June and early July. Pittsburgh steel companies have made large sales of their shell steel discards, the amount taken by English buyers being put at 120,000 tons.

On the Pacific coast four new vessels have just been ordered, calling for 12,500 tons of steel. In railroad steel, there is a 14,000-ton order at Chicago from one of the Canadian systems; some delayed Western buying of nuts and bolts, in which the roads seem to have profited by waiting; an inquiry for 1000 twin hopper cars for the Delaware & Hudson, that will take 15,000 tons of steel, and the expectation that the Pennsylvania Railroad will ask for 5000 steel underframe cars.

In all districts the effect of unusually hot weather in cutting down output has been intensified in the past week. Some mills, therefore, have fallen further behind, whereas gains on order books were expected.

It will soon be determined how the balance will be struck in foundry iron prices between the lessened operations of foundries due to labor's holidays and the reduced pig iron output from the forcing out of furnaces for repairs. The weakness due to resale iron continues. In the Chicago district malleable pig iron has sold at 50 cents below the recent market.

Pig iron output suffered in July from excessive humidity and from the blowing out of more furnaces for relining. The total was 3,226,719 tons or 104,088 tons a day, against 3,211,588 tons in June or 107,053 tons a day—a falling off of 3000 tons a day. There was a net loss of six furnaces in the month, 319 being active Aug. 1, with a daily capacity of 104,374 tons, against 325 on July 1, with a capacity of 107,822 tons a day.

The effect of export sales of Bessemer iron as a stimulant to the pig iron market is wearing off. The only notable transaction in basic iron was the purchase of 25,000 to 30,000 tons by a southern Ohio steel company for delivery in the first quarter of 1917. There was sharp competition between Ohio furnaces for this business.

Lake Superior iron ore shipments again exceeded every record in July, with a total of 9,750,157 gross tons. The season's movement to Aug. 1 was 29,365,724 tons, or more than 5,000,000 tons in excess of the previous record to that date, made in 1913. If the present rate of gain can be kept up, the season's shipments can easily exceed 60,000,000 tons. Lake seamen are agitating an increase in wages, but serious trouble is not looked for in the operation of boats.

Pittsburgh

PITTSBURGH, PA., Aug. 1, 1916.

The excessively hot weather of the past three weeks and the indifference of labor have cut down the output of iron and steel products from 15 to 20 per cent. This is being severely felt by the mills, which, instead of catching up on orders, are getting further behind. A car shortage has also developed in the past week, and when the Western grain commences to move it will likely get more acute. It is said that important railroads are figuring on unloading box cars in the East in their yards and hauling the material in wagons and trucks to the boats in order that cars may be returned as fast as possible. The chief feature of the market continues to be the enormously heavy demand for semi-finished steel in the form of billets, sheet bars and ingots. There is also a heavy export demand for barb wire, beams up to 12 in. and some other products. Of the 200,000 tons of barb wire for Russia lately placed definitely or tentatively, nearly half went to three or four independent mills. The domestic inquiry has quieted down, buyers not now being in the mood to cover for last and first quarters, but they are expected to come in the market about September. The expected advance in wire nails and wire has not been announced, but may come at any time. The pig-iron market is quiet and firm, but on

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics
At date, one week, one month, and one year previous

Pig Iron, Per Gross Ton:	Aug. 2, 1916.	July 26, 1916.	July 5, 1916.	Aug. 4, 1915.
No. 2 X, Philadelphia...	\$19.75	\$19.75	\$19.75	\$14.50
No. 2, Valley furnace...	18.25	18.25	18.25	12.75
No. 2 Southern, Cin'ti...	16.90	16.90	16.90	13.15
No. 2, Birmingham, Ala.	14.00	14.00	14.00	10.25
No. 2, furnace, Chicago...	19.00	19.00	19.00	13.50
Basic, del'd. eastern Pa.	19.00	19.00	19.50	14.00
Basic, Valley furnace...	18.00	18.00	18.00	13.00
Bessemer, Pittsburgh...	21.95	21.95	21.95	15.20
Malleable Bess., Ch'go...	19.00	19.50	19.50	13.50
Gray forge, Pittsburgh...	18.70	18.70	18.70	13.45
L. S. charcoal, Chicago...	19.75	19.75	19.75	15.75

Billets, etc., Per Gross Ton:	Aug. 2, 1916.	July 26, 1916.	July 5, 1916.	Aug. 4, 1915.
Bess. billets, Pittsburgh...	43.00	42.00	42.00	22.50
O.-h. billets, Pittsburgh...	45.00	45.00	42.00	22.50
O.-h. sheet bars, P'gh...	45.00	45.00	42.00	23.50
Forging billets, base, P'gh	69.00	69.00	69.00	28.00
O.-h. billets, Phila...	45.00	45.00	50.00	30.00
Wire rods, Pittsburgh...	55.00	55.00	50.00	26.00

Finished Iron and Steel,	Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.47½	1.47½	1.47½	1.25	
O.-h. rails, heavy, at mill	1.56½	1.56½	1.56½	1.34	
Iron bars, Philadelphia...	2.659	2.659	2.659	1.35	
Iron bars, Pittsburgh...	2.50	2.50	2.50	1.25	
Iron bars, Chicago...	2.35	2.35	2.35	1.20	
Steel bars, Pittsburgh...	2.50	2.50	2.75	1.30	
Steel bars, New York...	2.669	2.669	2.919	1.469	
Tank plates, Pittsburgh...	3.50	3.50	3.25	1.25	
Tank plates, New York...	3.669	3.669	3.419	1.419	
Beams, etc., Pittsburgh...	2.50	2.50	2.50	1.30	
Beams, etc., New York...	2.669	2.669	2.669	1.469	
Skelp, grooved steel, P'gh	2.35	2.35	2.35	1.25	
Skelp, sheared steel, P'gh	2.45	2.45	2.45	1.30	
Steel hoops, Pittsburgh...	2.75	2.75	2.75	1.30	

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire,	Aug. 2, 1916.	July 26, 1916.	July 5, 1916.	Aug. 4, 1915.
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, P'gh	2.90	2.90	2.90	1.80
Galv. sheets, No. 28, P'gh	4.25	4.25	4.50	4.00
Wire nails, Pittsburgh...	2.50	2.50	2.50	1.60
Cut nails, Pittsburgh...	2.60	2.60	2.60	1.55
Fence wire, base, P'gh...	2.45	2.45	2.45	1.40
Barb wire, galv., P'gh...	3.35	3.35	3.35	2.50

Old Material, Per Gross Ton:	Aug. 2, 1916.	July 26, 1916.	July 5, 1916.	Aug. 4, 1915.
Iron rails, Chicago...	18.50	18.50	18.00	12.25
Iron rails, Philadelphia...	20.00	20.00	20.00	15.50
Carwheels, Chicago...	12.00	12.00	12.00	11.50
Carwheels, Philadelphia...	15.50	15.50	16.00	12.75
Heavy steel scrap, P'gh...	16.25	16.25	16.00	13.25
Heavy steel scrap, Phila...	14.75	15.00	14.75	13.00
Heavy steel scrap, Ch'go	15.25	15.25	14.00	11.25
No. 1 cast, Pittsburgh...	15.00	15.00	15.75	12.00
No. 1 cast, Philadelphia...	16.00	16.00	16.00	12.50
No. 1 cast, Ch'go (net ton)	11.50	11.50	11.50	9.50
No. 1 RR wrot, Phila...	19.50	19.50	19.50	14.00
No. 1 RR wrot, Ch'go (net ton)	15.25	15.25	14.50	9.75

Coke, Connellsville,	Aug. 2, 1916.	July 26, 1916.	July 5, 1916.	Aug. 4, 1915.
Per Net Ton at Oven:				
Furnace coke, prompt...	\$2.75	\$2.75	\$2.75	\$1.50
Furnace coke, future...	2.50	2.50	2.50	1.75
Foundry coke, prompt...	3.25	3.25	3.25	2.00
Foundry coke, future...	3.50	3.50	3.50	2.25

Metals,	Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York...	26.25	25.25	27.00	21.00	
Electrolytic copper, N. Y.	26.00	25.00	26.50	18.25	
Spelter, St. Louis...	9.25	10.25	10.75	17.25	
Spelter, New York...	9.50	10.50	11.00	17.50	
Lead, St. Louis...	6.00	6.00	6.65	4.90	
Lead, New York...	6.10	6.20	6.85	5.00	
Tin, New York...	38.00	38.00	38.87½	35.50	
Antimony, Asiatic, N. Y.	12.50	13.50	16.00	34.50	
Tin plate, 100-lb. box, P'gh	\$6.00	\$6.00	\$6.00	\$3.10	

Bessemer and open-hearth semi-finished steel prices are \$3 to \$5 per ton higher, steel being scarcer than in early June. The scrap market is neglected, with prices easy. The scarcity of labor and the hot weather are again cutting down the output of coke, prices on the better grades for prompt shipment being very strong. Steel makers state that developments of the past month, particularly the heavy export demand for steel products, assure the continuance of present abnormal conditions in the steel trade over the remainder of 1916, with indications becoming stronger every day that they may extend some months into next year.

Pig Iron.—W. P. Snyder & Co. report the average price of Bessemer iron in July to have been \$21, and of basic, \$18, per gross ton, at Valley furnace, the same average prices as ruled in June. The local market is quiet, but, with three furnaces in the Pittsburgh and Valley districts out of blast, and two others likely to go out soon, a buying movement in both Bessemer and basic by several of the large steel companies may occur at any time, when, it is believed, prices on those grades iron would soon show a marked advance, as they have been out of line when compared with other materials for many months. There is some inquiry for foundry iron for first half delivery, and one sale of about 1200 tons, equal monthly deliveries in first half, has been made at about \$18.25, Valley furnace. We quote Bessemer iron at \$21; basic, \$18; gray forge, \$17.75 to \$18; malleable Bessemer, \$18.50 to \$19, and No. 2 foundry, \$18.25 to \$18.50, all at Valley furnace, the freight rate to the Pittsburgh and Cleveland districts being 95c. per gross ton.

Ferrolloys.—It is reported that prices on 50 per cent ferrosilicon have been advanced \$3 to \$5 per ton. The market on ferromanganese is quiet and prices for prompt are lower, domestic 80 per cent being offered at \$165 to \$175 at furnace. Prices on spiegeleisen are also lower, and we quote 18 to 22 per cent at \$40 to \$45, and 25 to 30 per cent, \$55 to \$65, at furnace. On 50 per cent ferrosilicon, we quote \$88 to \$89 in lots up to 100 tons; over 100 tons, \$87 to \$88, and over 600 tons, \$86 to \$87, all per gross ton, f.o.b. Pittsburgh. We quote Bessemer ferrosilicon as follows: 9 per cent, \$30; 10 per cent, \$31;

11 per cent, \$32; 12 per cent, \$33; 13 per cent, \$34.50; 14 per cent, \$36.50; 15 per cent, \$38.50, and 16 per cent, \$41. Seven per cent silvery is \$28.50; 8 per cent, \$29; 9 per cent, \$29.50; 10 per cent, \$30; 11 per cent, \$31, and 12 per cent, \$32. These prices are f.o.b. at furnace, Jackson or New Straitsville, Ohio, or Ashland, Ky., all having a freight rate of \$2 per gross ton to Pittsburgh.

Billets and Sheet Bars.—Soft Bessemer and open-hearth semi-finished steel, and, in fact, all grades are scarcer now, and are \$3 to \$5 per ton higher than early in June. Several of the large steel companies have run into a shortage in their own supply, and are trying to buy either billets or sheet bars in the open market. It is stated that one leading interest has recently sold about 120,000 tons of shell steel discards for shipment to England. Another maker has used up its supply of discard steel in the rolling of light rails. Export inquiry for small billets, 4 x 4-in. billets and sheet bars is still very heavy and \$45, Pittsburgh, for soft Bessemer or open-hearth steel, if it could be found, would be easily obtained. We note a sale of 2000 tons of 1½-in. billets, Bessemer or open-hearth steel at the seller's option, for export, at \$46, Pittsburgh. A sale of 300 tons of forging billets is also reported at about \$69, Pittsburgh, for delivery over the remainder of the year. We quote soft open-hearth billets and sheet bars at \$45; Bessemer billets, \$43 to \$45, and Bessemer sheet bars, \$43 to \$45, maker's mill, Pittsburgh or Youngstown district. We quote forging billets at \$69 for sizes up to but not including 10 x 10 in., and for carbons up to 0.25, the regular eqtras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take \$1 extra.

Plates.—The situation in plates as regards supply is getting worse, and 2.90c. on ¼-in. and heavier sheared plates for delivery at convenience of the mill, which would be in the last quarter of this year or first quarter of 1917, now seems to be minimum of the market. For delivery in two to four months, a few mills quote as low as 3.50c., while others will not shade 4c., and claim to be making sales at this figure. New inquiry for steel cars is light. The Boston Elevated Railway Company has placed 42 passenger cars and 50 articulated centers with the Pressed Steel Car Com-

pany, and also 50 motor cars with the Laconia Car Company, Laconia, N. H. The Pennsylvania Railroad has placed two 70-ft. passenger coaches with the Pressed Steel Car Company, and it is said will soon send out inquiries for 5000 freight cars with steel underframes. The Pressed Steel Car Company is furnishing a large amount of railroad equipment to the Russian State Railways. We quote $\frac{1}{4}$ -in. and heavier plates for delivery at convenience of the mill at 2.90c. to 3c., and for shipment in two to four months at 3.50c. to 4c. at mill.

Structural Material.—A large amount of new work is coming up all over the country. The Jones & Laughlin Steel Company has taken 900 tons for three new steel buildings for the Aluminum Company of America, Massena Springs, N. Y.; the McClintic-Marshall Company, 250 tons for a bridge in Philadelphia, and the Fort Pitt Bridge Works, 250 tons for the Brooklyn-Edison Company, Brooklyn, N. Y. Some of the Southern railroads that had bridges washed away in the recent floods have inquiries out for a large amount of new bridge work. Deliveries of shapes by the mills are still very unsatisfactory. We quote beams and channels up to 15 in. at 2.50c. to 2.75c. at mill, for delivery in third and fourth quarters, while small lots from stock are held at 3.25c. up to 4c., prices depending entirely on the size of the order and how soon deliveries are wanted.

Steel Rails.—It is said that several large contracts for standard sections and also for light rails have lately been placed with the Steel Corporation to be rolled at the Edgar Thomson mills of the Carnegie Steel Company. The Cambria Steel Company is reported to have used up a very large amount of discard steel recently in the rolling of light rails. On any large inquiries for standard sections or for light rails, the Carnegie Company could not quote for delivery before the second or third quarter of 1917. We quote 25 to 45 lb. sections at \$47; 16 and 20 lb., \$48; 12 and 14 lb., \$49; and 8 and 10 lb., \$50 in carload lots, f.o.b. at mill, the usual extras being charged for less than carload lots. We quote standard section rails of Bessemer stock at 1.47½c., and of open-hearth, 1.56½c., Pittsburgh.

Sheets.—While consumers are well covered on all grades of sheets, except galvanized, for the remainder of this year, new inquiry is heavy for the first quarter and first half of 1917. One inquiry is in the market for 10,000 tons of blue annealed sheets, but, with the sold-up condition of the mills it is not likely any one is in position to take this contract and make deliveries on it before late this year or early in 1917. Prices on galvanized sheets are a little stronger, some mills now quoting 4.35c. on No. 28 that two weeks ago quoted 4.25c. or less. On blue annealed and electrical sheets, mills are sold up for this year, but on Bessemer black and galvanized they can ship in 8 to 10 weeks. Prices are firm but unchanged. We quote blue annealed sheets, Nos. 9 and 10, at 3c. to 3.25c., for delivery at convenience of the mill. We quote No. 28 Bessemer and open-hearth black sheets at 2.90c. to 3c.; No. 28 galvanized, Bessemer, and open-hearth, 4.25c. to 4.35c.; Nos. 22 and 24 black plate, tin-mill sizes, H. R. & A., 2.90c.; Nos. 25, 26 and 27, 3c. to 3.10c.; No. 28, 3.10c. to 3.15c.; and No. 29, 3.20c. to 3.25c. These prices are for carloads and larger lots, f.o.b. mill, Pittsburgh.

Tin Plate.—The demand has quieted down, and it is believed consumers are pretty well covered for the remainder of this year. None of the mills can sell any more tin plate for delivery this year, with the chances that deliveries on some contracts will run into the first quarter of 1917. Output in the past three weeks has fallen off probably 20 per cent, due to the hot weather and also to the very high rates of wages tin-mill hands are receiving. These men earn as much in four days as they formerly earned in six, with the result that many work only four days a week, idling the other two. There is a shortage in tin-plate and sheet-mill skilled labor, and several leading concerns are advertising for men, promising steady work. Export inquiry is quiet, and what there is comes mostly from

Russia. We quote wasters from stock at \$5.75, and primes at \$6 to the domestic trade, while for export, \$6.25 per base box, and higher, is quoted. We quote 8-lb. coated ternes at \$8.50 to \$8.75 for 200 lb., and \$8.75 to \$9 for 214 lb., all f.o.b. Pittsburgh.

Skelp.—Mills report the new demand very quiet, but prices ruling firm. Nearly all the pipe mills roll their own skelp and the open market is very narrow. We quote grooved steel skelp at 2.35c. to 2.40c.; sheared steel skelp, 2.45c. to 2.50c.; grooved iron skelp, 2.70c. to 2.80c., and sheared iron skelp, 3c. to 3.10c., all delivered to consumers' mills in the Pittsburgh district.

Cold-Rolled Strip Steel.—We note one contract for 450 tons of cold-rolled strip steel for delivery over the remainder of this year at \$6 base per 100 lb., and several others for smaller amounts at the same price. We also note a sale of about 100 tons for prompt shipment, say in September and October, at \$6.75 base. No contracts for cold-rolled strip steel have yet been taken by makers for 1917 delivery, and it is said that all contracts contain a very tight non-cancellation clause. On contracts we quote cold-rolled strip steel at \$6 per 100 lb., base, and on small lots, for fairly prompt delivery, from \$6.50 to \$7. Extras, standard with all the mills, were printed on page 810 of THE IRON AGE of March 30.

Wire Rods.—Several fairly large export inquiries are in the market for Canada and Russia. On an inquiry for 1000 tons of open-hearth wire rods (carbon 0.40 to 0.50), one mill has quoted \$65, f.o.b. New York, and expects to get the order. The domestic demand for rods is quite heavy, some consumers being anxious to cover through the first quarter of next year. On soft Bessemer rods in large quantities to regular customers, mills are quoting \$50 to \$55, and on open-hearth \$55 to \$60. For the current demand, \$55 is minimum on either Bessemer or open-hearth rods. We quote soft Bessemer, open-hearth and chain rods at \$55 to \$60 per ton, f.o.b. Pittsburgh.

Wire Products.—It is stated that Russia has closed for between 200,000 and 225,000 tons of barb wire, slightly more than half of the order going to the leading maker, while about 80,000 to 100,000 tons were divided among four independent mills. One local maker took 20,000 tons, and another 25,000 tons, while a Youngstown mill is credited with having taken 20,000 tons and an Eastern mill about the same quantity. It is said that the price was close to 4c. per pound, f.o.b., Pittsburgh. The new demand for wire and wire nails is only fair, this being the worst of the dull season, and mills report specifications not active. It is believed, however, that the latter part of August will be better, as jobbers will desire to stock up for the fall trade. It is said that with the heavy export contracts for barb wire taken by the local mills, together with the demand from domestic trade that will have to be taken care of, there will be a decided shortage in barb wire this year. The expected advance in wire nails and wire has not yet been announced. Regular prices are as follows: Wire nails, \$2.50 to \$2.60 per keg, galvanized, 1 in. and longer, taking an advance over this price of \$2, and shorter than 1 in., \$2.50. Bright basic wire is \$2.65 per 100 lb. and annealed fence wire \$2.45; galvanized wire, \$3.15; galvanized barb wire and fence staples, \$3.35; painted barb wire, \$2.65; polished fence staples, \$2.65; cement-coated nails, \$2.50, base, all f.o.b., Pittsburgh, with freight added to point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are now 61½ per cent off list for carload lots, 60½ per cent for 1000-rod lots and 59½ per cent for small lots, f.o.b., Pittsburgh.

Railroad Spikes.—It is said that owing to the severe specifications in the inquiry from Russia for 50,000 kegs of dog-eared spikes, it is not likely any portion of this order, if it is placed, will be taken by local makers. One of the specifications is that the spikes shall be able to be driven 100 times in the tie and withdrawn. There is very little domestic demand for spikes, and makers are operating only intermittently, using the excess steel for other products which bring higher

prices. Regular prices, which are only fairly strong, are as follows:

Standard railroad spikes, $4\frac{1}{2}$ x $9/16$ in. and larger, \$2.65 to \$2.75; railroad spikes, $\frac{1}{2}$ and $7/16$ in., \$2.75 base; railroad spikes, $\frac{3}{4}$ in. and $5/16$ in., \$3.05 base; boat spikes, \$2.80 base, all per 100 lb., f.o.b. Pittsburgh.

Nuts and Bolts.—Both domestic and export demand are only fairly active, consumers being covered over the remainder of the year and shipments by makers are quite heavy. The hot weather and scarcity of labor are restricting output to some extent. Discounts in effect from May 19 are as follows, delivered in lots of 300 lb. or more, where the actual freight rate does not exceed 20c. per 100 lb., terms 30 days net, or 1 per cent for cash in 10 days:

Carriage bolts, small, rolled thread, 50 and 10 per cent; small, cut thread, 50; large, 40.

Machine bolts, h. p. nuts, small, rolled thread, 50, 10 and 5 per cent; small, cut thread, 50 and 5; large, 40 and 10.

Machine bolts, c. p. c. and t. nuts, small, 40, 10 and 5 per cent; large, 35 and 5. Blank bolts, 40 and 10 per cent; bolt ends with h. p. nuts, 40 and 10; with c. p. nuts, 35 and 5. Rough stud bolts, 15. Lag screws (cone or gimlet point), 50 and 10.

Forged set screws and tap bolts, 10 per cent. Cut and round point set screws, case hardened, 60. Square and hexagon head cap screws, 55. Flat, button, round or flister head cap screws, 30.

Nuts, h. p. sq., tapped or blank, \$2.90 off list; hex., \$2.90 off; c. p. c. and t. sq. tapped or blank, \$2.60 off; hex., \$3 off; semi-finished hex., 60 and 10 per cent; finished and case hardened, 60 and 10.

Rivets, $7/16$ in. in diameter and smaller, 45, 10 and 10 per cent.

Iron and Steel Bars.—Two of the larger steel bar makers in this district state that as yet they have not sold any for first half of next year delivery at less than 2.50c. at mill. They also claim to have taken some fairly large contracts at this price. It is also stated that in general implement makers are not disposed to contract at 2.35c., believing that price to be too high, their ideas being 2c., or not over 2.15c., for first half delivery. For new current demand, the general price on steel bars is 2.50c. for late delivery, while from warehouse small lots for prompt shipment bring 3c. to 3.25c. Nearly all large consumers are covered for the remainder of this year on old contracts for steel bars at 1.90c. to 2.10c., and deliveries on some of these contracts are certain to run over into the first quarter and perhaps second quarter of 1917. We quote refined iron bars at 2.50c. to 2.60c. and railroad test bars at 2.70c. to 2.80c. at mill.

Shafting.—The new demand is light, as consumers are covered, and some makers report a slowing down in specifications. The entire output of shafting is under contract for the next four or five months, and it is believed specifications will be more active in the last quarter. We quote cold-rolled shafting at 20 to 15 per cent off in carload lots for delivery in last quarter of this year and first quarter of 1917, and 10 per cent off in less than carload lots, f.o.b. Pittsburgh, freight added to point of delivery.

Cotton Ties.—Practically all the cotton tie business for this season has been done, and any belated orders placed in August are at an advance of $\frac{3}{4}$ c. per pound over the July price, which was \$1.35 per bundle of 45 lb., f.o.b. Pittsburgh.

Merchant Steel.—Output in July was cut down very much by the hot weather and scarcity of labor. Consumers are covered for this year and specifications are fairly active. Prices on small lots are about as follows: Iron-finished tire, $\frac{1}{2}$ x $1\frac{1}{2}$ in. and larger, 2.50c., base; under $\frac{1}{2}$ x $1\frac{1}{2}$ in., 2.60c.; planished tire, 2.70c.; channel tire, $\frac{3}{4}$ to $\frac{1}{2}$ and 1 in., 2.85c. to 2.95c.; $1\frac{1}{2}$ in. and larger, 3.25c.; toe calk, 2.95c. to 3.05c., base; flat sleigh shoe, 2.70c.; concave and convex, 2.75c.; cutter shoe, tapered or bent, 3.25c. to 3.35c.; spring steel, 2.95c. to 3.05c.; machinery steel, smooth finish, 2.75c.

Rivets.—Makers report the new demand only fair and specifications not so active as some time ago. Export inquiry is quite heavy, but not much is being placed, as makers say they are still having trouble in getting prompt deliveries of steel. Prices with manufacturers are stronger than with jobbers, the latter occasionally naming lower prices. Makers' prices are: Buttonhead structural rivets, $\frac{1}{2}$ in. in diameter and larger, at \$4 per

100 lb., base, and conehead boiler rivets, same sizes, \$4.10 per 100 lb., base, f.o.b. Pittsburgh. Terms are 30 days net, or one-half of 1 per cent for cash in 10 days.

Wrought Pipe.—The new demand for oil country goods is still heavy, but for butt and lap weld pipe is only fair. Some large gas and oil lines, mostly in Oklahoma, are being talked of, but they are slow in coming to a head. On lap weld pipe the mills are sold up for remainder of this year, but can ship out promptly on butt weld sizes. Discounts on black and galvanized iron and steel pipe are given on another page.

Boiler Tubes.—Specifications against contracts are heavy, but nearly all large consumers are covered over the remainder of the year. On locomotive and merchant tubes, mills are sold up for four or five months, and on seamless steel tubing largely through the first half of 1917. Discounts on iron and steel tubes are given on another page.

Old Material.—The local scrap market is quiet, new inquiry being light and prices soft. No large quantities of scrap are being pressed on the market, dealers realizing that consumers are not in a buying mood. At the same time, dealers will not sell short, believing the market will be higher later on. Prices quoted by dealers for delivery in Pittsburgh and nearby districts that take the same rates of freight, per gross ton, are as follows:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh, delivered	\$16.25 to \$16.50
No. 1 foundry cast	15.00 to 15.25
Re-rolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	16.25 to 16.50
Hydraulic compressed sheet scrap	13.50 to 13.75
Bundled sheet scrap, sides and ends, f.o.b. consumers' mills, Pittsburgh district	11.25 to 11.50
Bundled sheet stamping scrap	10.75 to 11.00
No. 1 railroad malleable stock	14.75 to 15.00
Railroad grate bars	9.00 to 9.25
Low phosphorus melting stock	19.50 to 20.00
Iron car axles	27.00 to 27.50
Steel car axles	27.00 to 27.50
Locomotive axles, steel	28.00 to 28.50
No. 1 busheling scrap	13.00 to 13.25
Machine-shop turnings	8.00 to 8.25
Old carwheels	13.00 to 13.25
Cast-iron borings	8.00 to 8.25
*Sheet bar crop ends	17.25 to 17.50
No. 1 railroad wrought scrap	18.25 to 18.50
Heavy steel axle turnings	11.00 to 11.25
Heavy breakable cast scrap	12.50 to 12.75

*Shipping point.

Coke.—Owing to the excessively hot weather and an acute shortage of labor in the coke regions, the supply of high grade blast-furnace coke for prompt shipment is light and it readily brings \$2.75 per net ton at oven. We note sales of 100 to 125 cars in the past week of high grade furnace coke for prompt shipment at \$2.75, but some grades that are not so high in quality can be had at \$2.50. Contracts for furnace coke for the remainder of the year have all been closed, and there is not much new inquiry. We quote furnace coke for prompt shipment at \$2.50 to \$2.75, and on contracts over the remainder of the year from \$2.35 to \$2.50, depending on the quality. We quote best grades of 72-hr. foundry coke for prompt shipment at \$3 to \$3.25, and on contracts \$3.25 to \$3.50 per net ton at oven. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended July 22 as 413,280 net tons.

Chicago

CHICAGO, ILL., Aug. 1, 1916.

In a small way inquiry and sales last week showed improvement. The turn in the spelter market was followed by a better inquiry for galvanized sheets, and sales were made at prices ranging from 4.30c. to 4.35c., Pittsburgh. Some implement makers are negotiating for rail-carbon steel for next year's delivery, of which material an increasing amount, in proportion to the total bar tonnage purchased, is being used. There has also appeared a delayed buying of bolts and nuts by some of the railroads. The Canadian Pacific has placed at Chicago 14,000 tons against its rail inquiry for 25,000 tons. Activity in structural steel is limited to small work, but of this kind of business fabricators appear to have plenty for a profitable operation of

their shops. There is a scattering car business, the most important inquiry being that of the Delaware & Hudson for 1000 twin hopper cars, for which approximately 15,000 tons of steel will be required. Except for the more sharply drawn contrast between plates of average width and the very narrow or very wide plates with respect to premium prices, there is little of interest in that direction. An adjustment of store prices for rivets and bolts to bring them into line with mill quotations is being undertaken. Inquiry for pig iron shows some increase and is to a greater extent the forerunner of buying than has latterly been the case. Against an inquiry for 2000 tons of malleable iron, 800 tons was purchased, resale iron winning out over furnace quotations. The scrap market shows no change toward greater activity.

Pig Iron.—The pig-iron situation, with all of its discouraging surface appearances, is considered by some sellers to have in it the possibility of a turn marked by active buying for the fourth and first quarters. Some encouragement is had in this direction from the inquiry of the past week, which includes several lots of 500 tons, concerning which there is every expectation of the iron being bought. The most depressing feature, however, is still the dominance of speculative iron available for resale. The Southern market has suffered most from this cause, but more recently reselling of Northern iron has made inroads on furnace business. On its inquiry for 2000 tons of malleable, an Indianapolis melter bought 800 tons or resale Ohio iron, paying it is understood, about 50c. per ton less than the equivalent of \$18 at the furnace. A sale of 1000 tons of malleable made last week was at \$19, Chicago furnace. This is 50c. below the price that has prevailed for some time. Despite the favoring prices for Southern iron as against Northern, for delivery at any distance from Chicago, there is little or no selling. For Lake Superior charcoal iron we quote delivery prices at Chicago to include a freight rate of \$1.75. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5.....	\$19.75
Lake Superior charcoal, No. 1.....	20.25
Lake Superior charcoal, No. 6 and Scotch....	20.75
Northern coke foundry, No. 1.....	19.50
Northern coke foundry, No. 2.....	19.00
Northern coke foundry, No. 3.....	18.50
Southern coke, No. 1 f'dry and 1 soft.....	\$18.50 to 19.00
Southern coke, No. 2 f'dry and 2 soft.....	18.00 to 18.50
Malleable Bessemer.....	19.00
Basic.....	19.00 to 19.50
Low phosphorus.....	34.00
Silvery, 8 per cent.....	29.50
Bessemer ferrosilicon, 10 per cent.....	32.50

Rails and Track Supplies.—The Canadian Pacific has been able to place at Chicago 14,000 tons of rails on its inquiry for 25,000 tons. This is the only recent rail buying of importance. Local mills have taken an additional 40,000 kegs of spikes to apply against the track-fastening requirements to accompany the recent Russian rail order. Quotations are as follows: Standard railroad spikes, 2.75c., base; track bolts with square nuts, 3.25c. to 3.50c., base, all in carload lots, Chicago; tie-plates, \$50, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, \$33, base; open-hearth, \$35; light rails, 25 to 45 lb., \$40; 16 to 20 lb., \$41; 12 lb., \$42; 8 lb., \$43; angle bars, 2c., Chicago.

Structural Material.—The fabricating shops, while they have on hand very little in the way of large work, an exception being the Mark Mfg. Company contract taken by the Morava Construction Company, have on their books a very satisfactory aggregate of business made up of jobs of 300 tons and less. Contracts reported as placed last week are also of this character. The American Bridge Company took 330 tons for an hotel annex at Dallas, Tex., 315 tons for bridges for the Duluth, Missabe & Northern Railroad, and 200 tons for the Chicago, Milwaukee & St. Paul. The Minneapolis Steel & Machinery Company will supply 200 tons for a high school at Rochester, Minn., while another school building at Lake Linden, Mich., calls for 150 tons. There is a scattering of car work, including the in-

quiry of the Delaware & Hudson for 1000 steel hopper cars, which will require about 15 tons apiece. The Pennsylvania Railroad also is preparing to enter the market. The Rock Island has bought 900 center sills and the Chicago & Northwestern has placed its order for mine cars with the Duncan Foundry & Machine Company, Alton, Ill. We quote for Chicago delivery of structural steel from mill, 2.689c.

We quote for Chicago delivery of structural steel from jobbers' stock 3.10c.

Plates.—Sales of plates are few in number and, for the ordinary domestic consumption, small as to tonnage. Transactions of the past week have simply served to indicate a continuance of the situation which has prevailed. Regular tank steel in average widths is selling at from 3.25c. to 3.50c., Pittsburgh, while very narrow and very wide plates are quoted at 4c. The delivery now is of less significance in determining the price than the size of the plates. We quote for Chicago delivery of plates from mill, 3.439c. to 3.689c., for prompt shipment, and 3.089c. for delivery at mill convenience.

We quote for Chicago delivery of plates out of jobbers' stock 3.50c.

Sheets.—The hope of a more stable price for spelter at the lower level to which it has come recently seems to have encouraged users of galvanized sheets to a more active interest. Inquiry has been noticeably better and a number of sales are reported, the prices ranging from 4.30c. to 4.35c., Pittsburgh, for No. 28. Demand for black sheets continues stagnant. For sheets of special finish, for automobile and metal furniture construction, there is a demand considerably in excess of the available mill supply. We quote for Chicago delivery, blue annealed, No. 16 and heavier, 3.089c. to 3.339c.; box annealed, No. 17 and lighter, 2.939c. to 3.039c.; No. 28 galvanized, 4.439c. to 4.589c.

We quote for Chicago delivery of sheets out of stock, minimum prices applying on bundles of 25 or more, as follows: No. 10 blue annealed, 3.40c.; No. 28 black, 3.10c. to 3.20c.; No. 28 galvanized, 5c. to 5.10c.

Bars.—The appearance of implement inquiry covering rail-carbon steel bars for first half delivery had some prominence last week. A number of sales were made, prices being at the market. The excessive heat of the last week interfered with mill operations to a considerable extent, and some of the bar-iron mills were shut down for two or three days. We quote mill shipment, Chicago, as follows: Bar iron, 2.35c.; soft steel bars, 2.689c. to 2.939c.; hard steel bars, 2.50c.; shafting, in carloads, 25 per cent off; less than carloads, 20 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 3.10c.; bar iron, 3.10c.; reinforcing bars, 3.10c. base with 5c. extra for twisting in sizes 1½ in. and over and usual card extras for smaller sizes; shafting 10 per cent off.

Rivets and Bolts.—Belated railroad inquiry for bolts and nuts has appeared in the market and it is not improbable that these roads will profit by their delay. The market for hot pressed nuts, in particular, shows decided irregularity in quotations. Makers of rivets are encouraged by the firming up of the store position, which for some time has been an excuse to some manufacturers for making concessions. We quote carriage bolts up to ¾ x 6 in., rolled thread, 50-10-5; cut thread, 50-5; larger sizes, 40-5; machine bolts up to ¾ x 4 in., rolled thread, with hot pressed square nuts, 50-10-10; cut thread, 50-10; larger sizes, 40-10-5; gimlet-point coach screws, 60; hot pressed nuts, square, \$2.90 off per 100 lb.; hexagon, \$2.90 off. Structural rivets, ¾ to 1¼ in., 4c. to 4.15c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

The price of rivets out of store has been advanced \$5 per ton and is now more nearly in keeping with mill prices for prompt shipment business. We quote out of store: Structural rivets, 3.75c.; boiler rivets, 3.85c.; machine bolts up to ¾ x 4 in., 60-10; larger sizes, 50-10; carriage bolts up to ¾ x 6 in., 60-5; larger sizes, 50 off; hot pressed nuts, square, \$3.25, and hexagon, \$3.25 off per 100 lb.; lag screws, 65.

Wire Products.—Wire mills report new sales of barb wire to Canada and a sustained improvement in the movement of wire nails in Western territory. The

anticipation of higher prices has not yet been realized. We quote as follows: Plain wire, Nos. 6 to 9, base, \$2.839; wire nails, \$2.689; painted barb wire, \$2.839; galvanized barb wire, \$3.539; polished staples, \$2.839; galvanized staples, \$3.539; all Chicago.

Cast-Iron Pipe.—The leading interest is the low bidder for 300 tons of pipe at Garrison, N. D., and has also taken a contract for 1000 tons of gas pipe. New inquiry for municipal pipe includes 300 tons for Lincoln, Neb., 400 tons for Glen View, Ill., and 150 tons each for Riverton, Wyo., and Marshalltown, Iowa. We quote as follows, per net ton, Chicago: Water pipe, 4 in., \$33.50 to \$34; 6 in. and larger, \$30.50 to \$31, with \$1 extra for class A water pipe and gas pipe.

Old Material.—Consumer buying continues discouragingly out of proportion to the scrap available for marketing. The mills rolling iron and rail steel are generally in possession of very heavy stocks and seem to have coming in, on old orders or exchange deals, nearly enough to offset current consumption. While the present low prices might be explained on the basis of the plentiful supply of scrap, even with a normal volume of buying, the reasons for the exceptional lack of interest on the part of purchasers, when considered in the light of comparatively heavy mill operations, are less clear, save as it may be accounted for by an unusual amount of conversion tonnage. The demand for steel axles for export is again uncertain with the completion of current outstanding orders and lower prices are likely to appear again. Since iron axles were recently sold by a railroad at a price around \$26, it is stated that offerings have failed to bring out better than \$22. With the exception of a large Pennsylvania Railroad list and 3000 tons from the Chicago & Northwestern, offerings in this market for the current week are small. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton	
Old iron rails.....	\$18.50 to \$19.00
Relaying rails.....	19.50 to 20.50
Old carwheels.....	12.00 to 12.25
Old steel rails, rerolling.....	15.50 to 15.75
Old steel rails, less than 3 ft.....	15.00 to 15.25
Heavy melting steel scrap.....	15.25 to 15.50
Frogs, switching and guards, cut apart.....	15.25 to 15.50
Shoveling steel.....	14.75 to 15.00
Steel axle turnings.....	9.25 to 9.75
Per Net Ton	
Iron angles and splice bars.....	\$18.75 to \$19.00
Iron arch bars and transoms.....	19.50 to 20.00
Steel angle bars.....	13.50 to 14.00
Iron car axles.....	25.50 to 26.00
Steel car axles.....	28.00 to 28.50
No. 1 railroad wrought.....	15.25 to 15.75
No. 2 railroad wrought.....	14.25 to 14.50
Cut forge.....	14.25 to 14.50
Pipes and flues.....	10.75 to 11.00
No. 1 busheling.....	12.25 to 12.75
No. 2 busheling.....	8.50 to 9.00
Steel knuckles and couplers.....	13.50 to 14.00
Steel springs.....	14.00 to 14.50
No. 1 boilers, cut to sheets and rings.....	9.75 to 10.25
Boiler punchings.....	13.50 to 14.00
Locomotive tires, smooth.....	20.00 to 20.50
Machine-shop turnings.....	5.50 to 6.00
Cast borings.....	6.00 to 6.50
No. 1 cast scrap.....	11.50 to 12.00
Stove plate and light cast scrap.....	9.25 to 9.75
Grate bars.....	10.00 to 10.25
Brake shoes.....	9.75 to 10.25
Railroad malleable.....	11.25 to 11.75
Agricultural malleable.....	10.75 to 11.25

Philadelphia

PHILADELPHIA, Pa., Aug. 1, 1916.

Billets and plates show a little added strength, a prominent maker of the former asking \$45, Eastern mill, for open-hearth rerolling billets, instead of quoting the Pittsburgh base as heretofore. Bessemer steel is scarcer. The export inquiry for all manner of steel products appears to be growing, and is pouring in on mills which heretofore have not been extensively favored. It comes direct by cable and letter as well as from export agents. Many thousand tons of shell steel are under inquiry here, as elsewhere. The demand for wire nails and wire products is active, but wire fencing is quiet, inasmuch as this is not the season when farmers give much attention to fences. It is predicted that if the export demand for steel keeps up, as it shows every indication of doing, domestic consumers who dally

too long in placing contracts for their future requirements may encounter difficulty in getting material, even at higher prices. The pig-iron market is flat, except for the export demand, for which there is none too much iron available. Old material shows no improvement; on the contrary, heavy melting steel is easier.

Pig-Iron.—The domestic market is flat, with the few transactions reported confined to small lots which in the aggregate do not amount to much. Most of the furnaces are so well sold up, however, that the dullness is not inciting pressure to sell, such as frequently occurs in periods of quiet. The producers are feeling optimistic, and predict a heavy movement in September or before. Foreign inquiry for Bessemer and low phosphorus continues to appear, and in this connection a situation has developed which demonstrates the active consumption of foundry grades. Makers of low phosphorus, desirous of concentrating to the fullest extent on that grade, have asked their foundry customers if shipments against their contracts may be delayed, but the answer has invariably been in the negative. The only recourse of the low phosphorus makers is to make deliveries to the foundries to the best of their ability, possibly arranging for the delivery of other brands where they can. For a carload of Bessemer a domestic consumer is reported to have paid \$25, delivered. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa., No. 2 X foundry.....	\$19.75 to \$20.25
Eastern Pa., No. 2 plain.....	19.50 to 20.00
Virginia, No. 2 X foundry.....	21.25
Virginia, No. 2 plain.....	20.75
Gray forge.....	18.50 to 19.00
Basic.....	19.00 to 19.50
Standard low phosphorus.....	34.00

Iron Ore.—Arrivals of foreign ore at this port in the week ended July 29 consisted of 4100 tons from Spain and 7700 tons from Cuba.

Ferroalloys.—Both foreign and domestic 80 per cent ferromanganese are obtainable at \$175, seaboard, for prompt or future delivery. The domestic product is weak, and \$175 could probably be shaded. The market is quiet. A purchase of 500 tons of spiegeleisen is reported at a price believed to have been slightly above \$50, furnace. Contract ferrosilicon, 50 per cent, is now quoted at \$86 to \$88, Pittsburgh, according to quantity, and 11 per cent at \$35.44.

Plates.—The week has been even more active than the preceding one, with heavy orders from shipyards, tank shops, locomotive works and miscellaneous consumers. While quotations are unchanged at 3.659c. to 4.159c., Philadelphia, the tone of the market is stronger, partly because of deliveries being further off, and because of increased strength at Pittsburgh. A mill in the East which has been making fairly prompt deliveries reports that it is nearly filled up. With others, orders continue to keep pace with production. Export inquiries are heavy.

Bars.—The quantity of Bessemer bars obtainable at 2.659c., Philadelphia, is steadily becoming more restricted, and more than this price is asked except for the most desirable class of business. Open-hearth bars are nominally 2.659c., Philadelphia, but up to 3.659c. is asked on current business. Iron bars are moving well at 2.659c., Philadelphia, and business in that direction is reported with export agents who look after the shipping end after delivery at seaboard.

Structural Material.—The minimum quotation is 2.909c., Philadelphia, but this price is made only on choice propositions and there are few of these. On current business 3.159c., Philadelphia, is asked. The trade is interested in a railroad project known as the Washington & Newport News Short Line, which, it is estimated, will require 17,000 to 20,000 tons of bridge work, etc., but the plans are moving slowly, as so often is the case with railroad enterprises.

Billets.—The market is stronger. For open-hearth rerolling billets, \$45, Eastern mill, is quoted. A maker of Bessemer billets quotes \$45, Pittsburgh, or \$47.56, Philadelphia, and has less steel to offer. Forging steel is unchanged at \$65.

Sheets.—Quotations for No. 10 blue annealed range from 3.159c. to 3.659c., the first named price applying

only to contracts. New Western mills, in their zeal to get business, are reported to have quoted slightly under 3c., Pittsburgh.

Coke.—The market is slightly firmer, not because of any increase in demand, but due to the heat in the coke regions, where, in some cases, the workmen have refused to load box cars because of the high temperature. Quotations are unchanged at \$2.75 per net ton at oven for spot furnace and \$2.50 to \$2.65 for contract furnace. Both prompt and contract foundry range from \$3.25 to \$3.50 per net ton at oven. Freight rates from the principal producing districts are as follows: Connellsville, \$2.05; Latrobe, \$1.85, and Mountain, \$1.65.

Old Material.—Heavy melting steel is a trifle easier, in a market that is quiet to dullness. Important points are still embargoed, and the situation is generally unchanged. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania, and taking freight rates from 35c. to \$1.35 per gross ton, are as follows:

No. 1 heavy melting steel.....	\$14.75 to \$15.25
Old steel rails, rerolling.....	17.00 to 18.00
Low phos. heavy melting steel scrap..	20.50 to 21.50
Old steel axles (nominal).....	30.00 to 31.00
Old iron axles (nominal).....	28.00 to 29.00
Old iron rails.....	20.00 to 20.50
Old carwheels.....	15.50 to 16.00
No. 1 railroad wrought.....	19.50 to 20.00
Wrought-iron pipe.....	12.50 to 13.00
No. 1 forge fire.....	12.50 to 13.00
Bundled sheets.....	12.50 to 13.00
No. 2 busheling.....	10.50 to 11.00
Machine-shop turnings.....	8.50 to 9.00
Cast borings.....	10.00 to 10.50
No. 1 cast.....	16.00 to 16.50
Grate bars, railroad.....	11.75 to 12.25
Stove plate.....	11.75 to 12.25
Railroad malleable.....	13.50 to 14.00

Cleveland

CLEVELAND, OHIO, Aug. 1, 1916.

Iron Ore.—Outside of the curtailment of production in the underground mines in the Mesaba district, conditions in the ore trade are very satisfactory. Shipments continue heavy, and the restriction of production on the Mesaba range apparently has had very little effect, being offset by the increased production in open-pit properties. Although the Mesaba strike is broken, not many of the men are returning to work and operations in but few of the underground properties have been resumed. Lake seamen will probably demand an increase in wages, but trouble is not looked for in the operation of boats. We quote ore prices as follows, delivered lower Lake ports: Old range Bessemer, \$4.45; Mesaba Bessemer, \$4.20; old range non-Bessemer, \$3.70; Mesaba non-Bessemer, \$3.55.

Pig Iron.—The market is almost lifeless. The effect of the labor shortage and decreased consumption, due partly to the molders refusing to work but part of the time during the extremely hot weather, is being felt more by the blast furnaces in the increase of orders to hold up shipments on foundry iron. Some foundries now have large stocks, having continued to take iron until their yards were filled. In the absence of inquiries of any size for several weeks, quotations are nominal and furnacemen do not venture to guess what price will come out in response to a round-lot inquiry. However, \$18 would probably be quoted for No. 2 foundry for out-of-town shipment. Southern iron is dull and unchanged at \$14 to \$14.50, Birmingham, for No. 2 for last half, and \$14.50 to \$15 for the first half of next year. Silvery iron is nominally unchanged, but it is admitted that an inquiry would bring out considerably lower than regular quotations because of the competition of the Tennessee furnaces. We quote, delivered Cleveland, as follows:

Bessemer.....	\$21.95
Basic.....	18.95
Northern No. 2 foundry.....	\$18.70 to 18.80
Southern No. 2 foundry.....	18.00 to 18.50
Gray forge.....	18.50
Jackson County silvery, 8 per cent	
silicon.....	28.62 to 30.62
Standard low phos., Valley furnace.....	32.00

Coke.—There is a scarcity of both furnace and foundry grades for prompt shipment, and some of the producers have advanced their prices on foundry coke for prompt shipment to \$3.60. A Cleveland interest has

paid as high as \$2.85 per net ton at oven for a small lot of Connellsville furnace coke for prompt shipment. We quote standard Connellsville foundry coke at \$3.25 to \$3.50 per net ton at oven for contract and \$3.25 to \$3.50 for prompt shipment.

Bolts, Nuts and Rivets.—New bolt and nut inquiries for both prompt shipment and contracts have improved. Specifications are heavy and deliveries are getting no better. Although there is some shading, prices generally are well maintained. The demand for rivets continues quite active. We quote rivets at 4c., Pittsburgh, for structural and 4.10c. for boiler rivets for prompt shipment and contract. Bolt and nut discounts are as follows:

Common carriage bolts, $\frac{3}{4}$ x 6 in., smaller or shorter, rolled thread, 50 and 10; cut thread, 50; larger or longer, 40; machine bolts with h. p. nuts, $\frac{3}{4}$ x 4 in., smaller and shorter, rolled thread, 50, 10 and 5; cut thread, 50 and 5; larger and longer, 40 and 10; lag bolts, gimlet or cone point, 50 and 10; square h. p. nuts, blank or tapped, \$2.90 off the list; hexagon, h. p. nuts, blank or tapped, \$2.90 off; c. p. c. and t. sq. nuts, blank or tapped, \$2.60; hexagon nuts, all sizes, \$3 off; cold pressed semi-finished hexagon nuts, all sizes, 60 and 10.

Old Material.—There is practically no activity in the scrap market. Local mills are still well supplied and dealers find it hard to move material even at price concessions. There is still an embargo against the Upson plant and two other local steel plants are not taking material. Relaying rails have become scarce owing to the disposition of some of the railroads not to sell this material. Iron car axles are also scarce, a foreign demand having developed for this grade as well as for old steel axles. We quote, f.o.b., Cleveland, as follows:

Per Gross Ton	
Steel rails.....	\$14.75 to \$15.00
Iron rails.....	13.50 to 19.00
Steel car axles.....	30.00 to 32.00
Heavy melting steel.....	15.00 to 15.25
Carwheels.....	12.75 to 13.00
Relaying rails, 50 lb. and over.....	22.50
Agricultural malleable.....	12.50 to 12.75
Railroad malleable.....	14.00 to 14.25
Steel axle turnings.....	12.00 to 12.50
Light bundled sheet scrap.....	12.00 to 12.25

Per Net Ton	
Iron car axles.....	\$24.00 to \$25.00
Cast borings.....	6.00 to 6.25
Iron and steel turnings and drillings..	5.75 to 6.00
No. 1 busheling.....	11.00 to 11.25
No. 1 railroad wrought (nominal)....	15.00 to 15.50
No. 1 cast.....	13.00 to 13.50
Railroad grate bars.....	10.00 to 10.50
Stove plate.....	10.00 to 10.25

Finished Iron and Steel.—One independent mill has opened its books for steel-bar contracts for the first half of 1917 at 2.50c., Pittsburgh, and while not soliciting business has closed with a few consumers anxious to get under cover. None of this business has come from the Ohio implement trade. July specifications show a falling off as compared with June. However, many consumers are crowding mills as hard as ever for shipments and the delivery situation is apparently growing worse in some lines. Some of the shipments on specifications sent in early in the year for July delivery will not be made until September or October. New inquiry for steel, both for early shipment and for contracts, has improved somewhat. The demand for steel bars for early shipment continues fairly active. They are quoted at 2.50c., Pittsburgh, for Bessemer bars for delivery within about two months. A northern Ohio manufacturer is in the market for 12,000 tons of 6-in. rounds for shells, but is having trouble in finding a mill in position to quote on this inquiry. Another inquiry is for 2000 tons of plates for water pipe. Plates are in good demand and local prices range from 3.25c. to 3.50c., Pittsburgh. However, mills making plates in light gages and narrow sizes are eager for business, and prices on these are somewhat easier, the usual quotation being around 3c., Pittsburgh. Inquiry for structural material is very light. There is a local inquiry for 1000 tons of 60-lb. rails for export to Cuba. The demand for hard steel bars is moderate and mills have apparently settled down to a uniform quotation of 2.50c. at mill. Bar iron is quoted at 2.50c., Cleveland. The blue annealed sheet market is active, but the demand for black and galvanized sheets is rather light. We quote sheets at 2.90c. to 3c., Ohio mill, for No. 28

black; 3c. to 3.25c. for No. 10 blue annealed, and 4.25c. to 4.40c. for No. 28 galvanized. Warehouse prices are 3.25c. for steel bars and structural material, 3.65c. for plates and 3.20c. for iron bars.

Cincinnati

CINCINNATI, OHIO, Aug. 2, 1916.—(By Wire.)

Pig Iron.—A southern Ohio steel company has purchased 25,000 to 30,000 tons of Northern basic iron for first-quarter shipment. It is rumored that another consumer of basic is testing the market, but as far as known no definite inquiry has yet been put out. Some Bessemer iron was sold for export last week by a local house. The foundry iron business is at a standstill. Only one small general inquiry from central Ohio has been issued lately. Order books are almost blank as regards foundry iron, and the largest sale reported is one for 150 tons for an Ohio foundry. Quotations are unchanged, but no late sales at the furnace price of \$19, Ironton, are known to have been made. The recent extremely hot weather has cut the consumption of basic and foundry iron below estimates. The silvery irons are inactive. From \$27 to \$29 at furnace is quoted by Northern producers on an 8 per cent analysis and around \$24, Birmingham basis, for Southern silvery. The inquiry for malleable mentioned last week is still said to be open. Based on freight rates of \$2.90 from Birmingham and \$1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft.	\$17.40 to \$18.40
Southern coke, No. 2 f'dry and 2 soft.	16.90 to 17.90
Southern coke, No. 3 foundry.	16.40 to 17.40
Southern coke, No. 4 foundry.	15.90 to 16.90
Southern gray forge.	15.40 to 16.40
Ohio silvery, 8 per cent silicon.	23.26 to 28.76
Southern Ohio coke, No. 1.	20.76 to 21.26
Southern Ohio coke, No. 2.	19.76 to 20.26
Southern Ohio coke, No. 3.	19.26 to 19.76
Southern Ohio malleable Bessemer.	19.76 to 20.26
Basic, Northern	19.76 to 20.26
Lake Superior charcoal.	21.20 to 22.20
Standard Southern carwheel.	24.90 to 25.40

(By Mail)

Finished Material.—No. 28 black sheets are still held by the nearby mills at 2.90c., Cincinnati or Newport, Ky., and No. 28 galvanized around 4.65c., with a slightly firmer feeling due to higher spelter. The extremely hot weather has cut down production, while the demand is said to be slightly improving. It is understood that the mills are not putting by any large stocks and prefer merely to keep up with the market demands. The warehouse price on No. 28 galvanized sheets ranges from 5c. to 5.25c. Weather conditions continue to affect adversely the call for all kinds of building material, and the warehouses as a rule report last week as not being a very satisfactory one. The mill supply business is also slow. We quote from local store stocks as follows: No. 10 blue annealed sheets, 3.50c.; steel bars and small structural shapes, 3.20c.; plates, 3.50c.; wire nails, \$2.75 per keg, base; barb wire, \$3.60 per 100 lb.

Old Material.—The small improvement noted last week has not kept up, as both the foundries and rolling mills are not consuming the usual tonnage of scrap and new contracting is said by many dealers to be almost at a standstill. However, this is considered a somewhat temporary condition that will doubtless improve as soon as the pig-iron market shows some life. The following are dealers' prices to consumers, f.o.b. at yards, southern Ohio and Cincinnati:

Per Gross Ton	
Bundled sheet scrap.	\$11.25 to \$11.75
Old iron rails.	15.50 to 16.00
Relaying rails, 50 lb. and up.	21.00 to 21.50
Rerolling steel rails.	14.50 to 15.00
Heavy melting steel scrap.	14.25 to 14.75
Steel rails for melting.	13.00 to 13.50
Per Net Ton	
No. 1 railroad wrought.	\$13.25 to \$13.75
Cast borings.	4.75 to 5.25
Steel turnings.	5.25 to 5.75
Railroad cast scrap.	11.00 to 11.50
No. 1 machinery cast scrap.	12.75 to 13.25
Burnt scrap.	8.25 to 8.74
Iron axles.	21.00 to 22.00
Locomotive tires (smooth inside).	19.75 to 20.25
Pipes and flues.	9.50 to 10.00
Malleable and steel scrap.	10.75 to 11.25
Railroad tank and sheet scrap.	8.50 to 9.00

Coke.—Shipments of foundry coke are going forward at a slower rate, although there have been no cancellations reported and not many requests for holding up the forwarding of coke. Producers in all districts have curtailed production at about the same rate as consumption has fallen off, due to the hot weather. We quote 48-hr. Connellsville coke at \$2.50 to \$2.75 per net ton at oven and the nominal figures given on foundry coke in the Connellsville, Wise County and Pocahontas fields range from \$2.35 to \$3.75. New River foundry coke remains at \$4 at oven.

Buffalo

BUFFALO, N. Y., Aug. 1, 1916.

Pig Iron.—The furnaces of the district report very small inquiry and "low ebb" buying. They are, however, shipping heavily on contracts and to the limit of daily production, besides making large inroads into stock on yards. In the face of the extremely light demand producers are making no effort to sell, but it is fair to assume that, although no material change is shown in the week's quotations, the prices at which the few sales made were based on the minimum rather than the maximum side. We quote as follows, f.o.b. furnace, Buffalo, for last half delivery:

No. 1 foundry	\$19.00
No. 2 X foundry	\$18.50 to 19.00
No. 2 plain	18.50 to 18.75
No. 3 foundry	18.50 to 18.75
Gray forge	18.25 to 18.50
Malleable	18.50 to 19.00
Basic	19.00 to 20.00
Bessemer	21.00 to 22.00
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—The leading producing interest announces an advance of \$2 per ton on steel bars effective to-day, making the price 2.60c., Pittsburgh base. An increase in inquiry is noted over last week, and some new buying, mostly carload lots, is reported. One large seller reports a marked change in sentiment among buyers as regards the desirability of placing new business in the near future, with indications that there may be a development of a buying movement in September or October. The pressure for delivery on contracts continues even more insistently than reported a week ago. Most mills report that the intense heat prevailing recently has had the effect of cutting down production 10 to 20 per cent on account of exhaustion of the men, and will tend to create extension in delivery dates. The demand for wire rods is very strong and the price is higher. The Corrugated Bar Company, Buffalo, has a contract with the Aberthaw Construction Company, Boston, to furnish 240 tons of reinforcing bars for three factory buildings to be erected by the latter company for the Buffalo Potteries. Bids are being taken for about 800 tons of steel for a bridge to be erected by the Lackawanna Railroad in Buffalo. The American Bridge Company has the contract for two highway bridges for the Eastman Kodak Company's terminal railroad, Rochester, 100 tons.

Old Material.—Sales of heavy melting steel were of good volume and prices for this commodity are being well maintained. Several good-sized inquiries are still before the market. A fair number of sales in turnings and borings were also reported, and the rest of the list was fairly active, with the exception of railroad malleable, cast scrap and carwheels, which were quiet. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel.	\$15.50 to \$16.00
Low phosphorus steel.	20.00 to 20.50
No. 1 railroad wrought scrap.	17.25 to 17.75
No. 1 railroad and machinery cast scrap.	15.50 to 16.00
Steel axles.	20.00 to 21.00
Iron axles.	26.00 to 27.00
Carwheels.	13.00 to 13.50
Railroad malleable.	15.00 to 15.50
Machine shop turnings.	6.00 to 6.50
Heavy axle turnings.	12.00
Clean cast borings.	7.25 to 7.75
Iron rails.	18.00 to 18.50
Locomotive grate bars.	11.50 to 12.00
Stove plate (net ton).	11.00 to 11.50
Wrought pipe.	12.00 to 12.50
Bundled sheet scrap.	11.50 to 12.00
No. 1 busheling.	12.00 to 12.50
No. 2 busheling.	11.00 to 11.50
Bundled tin scrap.	15.00 to 15.50

St. Louis

ST. LOUIS, MO., July 31, 1916.

Pig Iron.—Transactions have all been in the 100-ton class the past week, with no disposition on the part of melters to look to the future. The intense heat has also had the effect of slowing up work in the foundries; but there is an expectation of improved conditions with the determination of the effect of the weather upon crops and general business in St. Louis trade territory.

Coke.—Only small lots have been dealt in, all for immediate needs or special purposes. Prices remain on the Connellsville basis, with by-product coke held at a parallel figure, with no pressure to sell.

Finished Iron and Steel.—A noticeably better feeling is reported among the fabricators, although they have not begun to make any additions to their future contracts. Some inquiries have appeared for round lots of reinforcing bars. Movement out of warehouse has continued heavy, with prices for such stock as follows: Soft steel bars, 3.15c.; iron bars, 3.10c.; structural material, 3.15c.; tank plates, 3.55c.; No. 10 blue annealed sheets, 3.45c.; No. 28 black sheets, cold rolled, one pass, 3.30c.; No. 28 galvanized sheets, black sheet gage, 5c.

Old Material.—While there has been a stiffening in the values at which steel scrap is held, there has been no notable demand for such material from the mills nor for the other classes of scrap. It has been essentially a dealers' market, with an inclination to hold stocks at prices quoted even though there be no immediate demand. The quotations given are therefore on a nominal basis. Lists out this week include 1200 tons from the Mobile & Ohio and 750 tons from the Terminal Railroad Association of St. Louis. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails.....	\$16.25 to \$16.75
Old steel rails, rerolling.....	14.75 to 15.00
Old steel rails, less than 3 ft.....	14.50 to 15.00
Relaying rails, standard section, subject to inspection.....	22.00 to 23.00
Old carwheels.....	11.50 to 11.75
No. 1 railroad heavy melting steel scrap.....	14.25 to 14.50
Heavy shoveling steel.....	12.25 to 12.50
Frogs, switches and guards cut apart.....	14.25 to 14.50
Bundled sheet scrap.....	8.00 to 8.50
Per Net Ton	
Iron angle bars.....	\$15.75 to \$16.25
Steel angle bars.....	13.00 to 13.25
Iron car axles.....	24.50 to 25.00
Steel car axles.....	26.00 to 26.50
Wrought arch bars and transoms.....	18.50 to 19.00
No. 1 railroad wrought.....	14.00 to 14.50
No. 2 railroad wrought.....	13.75 to 14.25
Railroad springs.....	13.50 to 13.75
Steel couplers and knuckles.....	13.50 to 13.75
Locomotive tires, 42 in. and over, smooth inside.....	19.25 to 19.50
No. 1 dealers' forge.....	10.25 to 10.75
Cast-iron borings.....	5.75 to 6.25
No. 1 busheling.....	11.50 to 12.00
No. 1 boilers, cut to sheets and rings.....	8.25 to 8.50
No. 1 railroad cast scrap.....	10.75 to 11.00
Stove plate and light cast scrap.....	8.25 to 8.75
Railroad malleable.....	10.50 to 11.00
Agricultural malleable.....	9.50 to 10.00
Pipes and flues.....	9.50 to 10.00
Railroad sheet and tank scrap.....	9.00 to 9.50
Railroad grate bars.....	8.50 to 8.75
Machine-shop turnings.....	6.75 to 7.25

Birmingham

BIRMINGHAM, ALA., July 31, 1916.

Pig Iron.—The monotony of the Southern iron market has been unbroken for six to seven weeks. The average small lot characterizing the going business is sold on the basis existing prior to the present period of stagnation. The total export movement of the month of July figures around 15,000 tons. Mobilians, in presenting arguments for a 36-ft. channel there, claimed that 40,000 tons of steel made in Birmingham had been shipped through the port of New Orleans to France in the past month. Certainly movements from the Ensley mill of the Tennessee Company and the Fairfield plant of the American Steel & Wire Company have been quite regular and on a large scale. There is a floating inquiry in the Birmingham district for 16,000 tons of pig iron to consist of gray forge and Nos. 2, 3 and 4 foundry, indicating that some pipe interest is sounding the market. Quotations were asked for delivery over

the remainder of the year, with alternate prices for the first half of 1917. One manufacturer named \$15 and \$15.50 for the two periods. In this as in other cases, where these quotations were named, no business has followed. The situation seems to be this: While the market is absolutely listless, the consumers are taking the iron ordered far ahead several months ago; the leading interest is practically out of the foundry market on account of its own basic metal requirements; another large interest is sold throughout the remainder of the year on basic and several other grades, and a smaller concern is well covered for two to three months to come, while the remainder need be in no special hurry to take on new business. The result is that the Birmingham manufacturers seem to agree that if a good buying movement sets in by September 1 the situation will be saved. There are no fresh evidences of price cutting any more than there is evidence of real business. Carload lots of No. 2 soft have sold at \$15 and \$15.50. Resale metal brings what the holder can get, which is anywhere from \$13.50 (possibly less) to around \$14. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft.....	\$15.00 to \$15.50
No. 2 foundry and soft.....	14.50 to 15.00
No. 3 foundry.....	14.00 to 14.50
No. 4 foundry.....	13.75 to 14.25
Gray forge.....	13.50 to 14.00
Basic.....	14.50 to 15.00
Charcoal.....	22.00 to 22.50

Cast-Iron Pipe.—The character of operations at the larger water and gas pipe shops differs. Operations in one were slow in resuming after the national holiday, while in another a large aggregate of small orders put order books in good form. Conditions are still somewhat slack, but there is no disposition to shade prices. We quote, per net ton, f.o.b. Birmingham, as follows: 4-in., \$28; 6-in. and upward, \$25, with \$1 added for gas pipe and 16-ft. lengths.

Coal and Coke.—Alabama coal operators have not recovered the trade taken from them by the development of hydroelectricity. Many mines are working only a few days per week. The movement out of Mobile via the Warrior River for Gulf points is becoming freer, with additional craft. Coke is moving out rapidly in response to recent heavy orders. Prices remain firm at \$4.25 to \$4.50 per net ton at oven for standard beehive foundry and \$3.25 to \$3.50 for furnace coke.

Old Material.—No change has occurred in the scrap market, which remains a matter of bargaining on each sale. The activity of steel scrap users presages an early improvement in conditions. We quote, per gross ton, f.o.b. Birmingham district yards, as follows:

Old steel axles.....	\$22.00 to \$23.00
Old steel rails.....	10.00 to 10.50
No. 1 steel scrap.....	9.25 to 9.75
No. 1 wrought scrap.....	12.50 to 13.00
No. 1 cast scrap.....	10.50 to 11.00
Extra heavy cast scrap.....	9.50 to 10.00
Stove plate and light.....	9.00 to 9.50
Old carwheels.....	9.50 to 10.00
Tram carwheels.....	9.50 to 10.00

San Francisco

SAN FRANCISCO, CAL., July 25, 1916.

The adjustment of the waterfront labor trouble has caused a better feeling, permitting a freer movement of merchandise; but aside from that there is little change. Business is dull as compared with the spring months, though there is a fully normal jobbing movement, and there is no sign of curtailment in specifications from the larger consumers. The completion of new manufacturing plants and of additions to old ones is beginning to cause a perceptible increase in routine requirements, and as few of these enterprises are of a temporary nature a larger buying movement is expected for next year.

Bars.—Concrete reinforcing material continues in strong demand, with some fairly large building contracts and many small bridges all over the country. Most of this business is coming in single carloads or less, but amounts to a large tonnage. The movement of soft steel bars in some directions is rather slow, but heavier demands in the small shop trade are expected

in the fall. The larger concerns are specifying substantial tonnages, besides placing frequent orders for prompt delivery from store. Local values continue steady on the old basis of 4c. on jobbing sales, 3.50c. for prompt and 3c. for future shipment from local mills.

Structural Material.—Local shops are at considerable disadvantage just now on account of labor conditions, and comparatively little work is being placed here. There is considerable figuring, and a great many jobs are expected to come out in August, bridge work being especially active. The American Bridge Company recently took about 300 tons for a bridge in the San Joaquin Valley, and bids have been taken for a three-span bridge over the Russian River, Sonoma County. Plans are under way for a \$120,000 bridge on the Feather River at Live Oak, Cal. Bids will be taken Aug. 10 for a bridge on Digger Creek near Red Bluff, and plans are out for some bridges near Quincy, Cal. Bids will be opened Aug. 17 for a bridge near Florence, Ariz. Several bridges are projected near San Diego, Cal. Arrangements are being made for a large extension of the Hobart Building, this city, and it is reported that the Willys-Overland Company will build a large warehouse at Sacramento.

Plates.—Specifications for ship work are going forward in large volume, as several plants are getting extensions in shape to handle more plate work. While shipping rates are easier, there are still more inquiries for steel ships than can be considered, and there is no end of the present activity in sight. Such requirements are fairly well covered to the end of the year, and buyers are beginning to negotiate for further contracts, though it is not known whether anything has been definitely closed. Penstock and pipe work also make an important item, and some new business is coming out on this account. The Baker and Llewellyn Iron Works, Lacey Mfg. Company, Western Pipe & Steel Company and Los Angeles Mfg. Company are working on a large pipe order for the San Fernando water district, the total price being \$714,000.

Sheets.—The sharp decline on galvanized in the primary market is being followed rather slowly by the local trade. The effect on the volume of business has so far been hardly perceptible, but there is little doubt that a return to normal value will bring out a much better consuming demand as the fall buying season approaches, the recent high level having retarded trade greatly. Stocks appear to be not uncomfortably large. Specifications continue to come out well for blue annealed, but new orders are hard to place.

Wrought Pipe.—The drop of \$10 per ton on galvanized pipe effective the first of this week has brought a similar decline in resale prices, which tends to disturb the market temporarily. It is believed, however, that the lower price will have a stimulating effect within a short time. Merchant sizes show no great activity, but the jobbing movement has been about normal recently, and jobbers are beginning to sort up more freely. Oil country goods continue in fairly strong demand, but the delayed deliveries retard business.

Cast-Iron Pipe.—Municipal business is coming out a little more freely, and quite a tonnage is being booked in small orders from corporations. The town of Whittier, Cal., has just taken bids for about a mile of 12-in. pipe. Pasadena has ordered a lot of 24-in.; Los Angeles, 1050 tons of 4 and 6 in., and Othello, Ore., is figuring on a lot of 6-in. The city of Tacoma, Wash., is considering a project requiring a long pipe line and a lot of new mains.

Pig Iron.—The foundries both here and in the interior continue very busy, and there is apparently no curtailment in the tonnage melted. Shipments coming in on contracts, however, are about sufficient for current needs, and business is practically limited to a few scattering orders for prompt delivery. While some concessions might be had on new orders, local agents continue to ask about \$26 per gross ton for No. 1 Southern foundry iron; and values on iron bought by analysis are pretty well maintained.

Coke.—New business continues quiet, with a rather large tonnage arriving on contracts covering the re-

mainder of the year, which takes care of foundry needs without difficulty. Values hold fairly firm at a range of from \$15 to \$15.50 per net ton for Southern coke to \$17 or over for favored brands.

Old Material.—Cast-iron scrap continues in good demand, most local offerings being readily absorbed at \$16 to \$18 per net ton. Steel melting scrap is in rather less urgent demand than earlier in the season, owing to the large tonnage already secured by the principal melters and the ample supply in sight for future needs. There is a moderate movement, however, at about \$10 to \$12 per gross ton.

Ore.—A contract has just been closed for the hauling of 50 tons of chrome ore per day from the mine to the railroad at Fruto, Cal., in the Sacramento Valley, for a period of two years.

New York

NEW YORK, Aug. 2, 1916.

Pig Iron.—Domestic inquiry is for small lots, the largest sale reported being of 500 tons. Deliveries desired are for this year, indicating piecing out of requirements, and there is practically no interest in contracting for 1917. Export business is still far larger than domestic. J. P. Morgan & Co.'s negotiations for 5000 to 9000 tons of Bessemer iron, believed to be for France, have been concluded, but the exact amount taken has not been made public. The iron will come from Central Western Valley interests. The price is understood to have been somewhat under \$21 at furnace. Domestic inquiry is perhaps a trifle more active than in recent weeks, but that is saying little for an exceedingly dull situation. We quote at tidewater for early delivery: No. 1 foundry, \$20.50 to \$21; No. 2 X, \$19.75 to \$20.25; No. 2 plain, \$19.50 to \$20; Southern iron at tidewater, \$19.50 to \$20 for No. 1 and \$18.50 to \$19 for No. 2 foundry and No. 2 soft.

Finished Iron and Steel.—Manufacturing consumers appear to have enough stock on hand that specifications on contracts sent to the mills in July were relatively light and new buying was at a notably low ebb. Domestic commitments appear to be only for sheer needs. Mills not producing materials in active demand from abroad are here and there looking for buyers, and such cases are regarded as straws that indicate price concessions if August repeats the July experience. Sheets, narrow plates, universal plates and bar iron are put in this class. The check to buying for new projects or for equipment, such as railroad cars and locomotives, because of high prices; the increasing productive capacity in steel making; the restricted lines of the admittedly prodigious demand from the belligerents; the dullness of the present securities market, and the seemingly satiated demands of steel users are set down as causes. War business is exceedingly heavy, and offerings for early shipments are far beyond what the steel companies can consider. Besides this condition as a factor calculated to maintain the stiff general price situation, the hot-weather and labor-shortage checks are emphasized by those who see no weakness. Foreign buying for other than war uses is as yet of no consequence, as representatives here get no decisions from their principals, let alone the provision of satisfactory credit. One lot of 30,000 tons of plates is in this class. For war purposes it is now understood that Russia will take 340,000 tons of barbed wire all told. One late shell steel inquiry is for 25,000 tons for 6-in. projectiles. In fabricated steel in domestic markets, the activity is chiefly in railroad bridges, and some of these represent replacement of flood losses, mostly in North Carolina. Steel building work still shows the deterrent effect of high prices. That all fabricators, however, are not in great need of bookings is shown in bids received for the five bridges for the Southern Railway. In spite of the attractive character of the work, as to delivery and duplications of 100-ft. spans, the pound price differed between high and low bidders by \$35 per ton erected. Somewhat better deliveries are possible in plates, and 3.50c., Pittsburgh, is obtained for universal plates in an attractive lot and in cases 3.75c. for sheared plates.

The lettings in structural steel include 1500 tons of flood replacement, 700 tons for the Southern to be supplied by the Virginia Bridge & Iron Company and 800 tons for the Seaboard to be supplied by the American Bridge Company. The latter company and the Fort Pitt Bridge Works have each a bridge, the two totaling 150 tons, for the Boston & Maine, which is now in the market for two more bridges, or about 200 tons. Windsor, Conn., is taking bids on 300 tons in two bridges; the Philadelphia & Reading is to buy 200 tons of bridge work; the Piedmont & Northern needs to replace a 500-ton bridge in North Carolina, and the Baltimore & Ohio has placed 200 tons with the American Bridge Company. In general building work, some 2500 to 3000 tons will be required for a terminal station at Halifax, Nova Scotia, and 800 tons for an apartment at Broadway and Ninety-first Street, New York. The Gilbert & Barker factory steel work at Springfield, Mass., will be built by the Levering & Garrigues Company, and two residence jobs on East Seventy-ninth Street have been closed: the Rogers with the Harris-Silvers-Baker Company and the Newbold with the Hinkle Iron Company. In railroad car work, the Bettendorf Company is to supply 900 center constructions for the Rock Island and the Lehigh Valley has taken bids on 1500 box cars, while the Gadsden Car Works, it is understood, are not to buy the 1400 center constructions because of high prices. We quote mill shipments of plain structural material at 2.669c. to 2.919c., New York; steel plates at 2.919c. to 4.169c., depending on the width of the plate as much as on delivery, and with universal plates easier by \$5 to \$10 per ton than sheared plates; steel bars at 2.669c. to 2.919c., the lower price for the Bessemer product in several weeks, but for open-hearth steel at the convenience of the mill and little if any this year; bar iron at 2.669c., New York. Out of warehouse we quote iron and steel bars and shapes at 3.25c. to 3.30c., New York, and plates at 4c. to 4.25c.

Cast-Iron Pipe.—Nothing of special interest has transpired. No public lettings of consequence are announced, but private buying continues quite satisfactory. Carload lots of 6-in., class B and heavier, are firm at \$30.50 per net ton, tidewater, class A and gas pipe taking an extra of \$1 per ton.

Old Material.—Relaying rails are in active demand, not only for domestic use but also for export. Single transactions have run into thousands of tons. Old steel axles continue in active demand for export, and recently a better export trade has been done in rerolling rails. The inquiry from eastern Pennsylvania for heavy melting steel scrap and rolling-mill stock continues light. While for shipment West up to \$13.50 is offered for steel, brokers quote buying prices for the Eastern trade about as follows to local dealers and producers, per gross ton, New York:

Heavy melting steel scrap (eastern Pennsylvania specifications)	\$11.75 to \$12.00
Old steel rails (short lengths) or equivalent	12.50 to 12.75
Relaying rails	29.00 to 30.00
Rerolling rails	16.00 to 16.50
Rerolling rails (for export)	19.00
Iron car axles	28.00 to 29.00
Steel car axles (for export)	32.00 to 34.00
No. 1 railroad wrought	17.50 to 18.00
Wrought-iron track scrap	15.50 to 16.00
No. 1 yard wrought, long	13.50 to 14.00
No. 1 yard wrought, short	11.75 to 12.00
Light iron (nominal)	3.50 to 4.00
Cast borings (clean)	7.25 to 7.50
Machine shop turnings (nominal)	4.25 to 4.50
Mixed borings and turnings	4.25 to 4.50
Wrought pipe	10.00 to 10.50
Old carwheels (nominal)	15.00 to 15.50
Malleable cast (railroad)	12.25 to 12.50

The foundry trade shows no improvement. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery)	\$16.00 to \$16.25
No. 2 cast (heavy)	14.50 to 15.00
Stove plate	12.00 to 12.25
Locomotive grate bars	12.00 to 12.25

Ferroalloys.—Very little has been done in ferromanganese, but \$170 has been established by some recent sales, with the probability that this price can be shaded. Export inquiries are still figuring in the market and include several thousand tons for Italy. The importation of over 12,000 tons in June, or at a rate

greater than the average before the war, together with efforts of some domestic producers to get business, has put consumers much more at ease as to future supplies. The quotation of \$50 at furnace for 20 per cent spiegeleisen is still maintained, but little is doing. Ferrosilicon is quoted at \$86 to \$88, Pittsburgh, prices advancing on the recent loss in production. Ferro-tungsten is easy at \$5 per lb. of contained tungsten. The demand from makers of high-speed tool steel is lighter in view of the smaller demand for their product, but the placing of new shell orders promises a heavier demand for tool steel. Ferrochrome, 60 to 70 per cent, is unchanged at 16c. to 20c., New York, per lb. of contained chromium. Ferrovandium stands at \$2.75 to \$3, Pittsburgh, per lb. of contained vanadium. High-carbon ferrotitanium, 15 per cent, is quoted at 8c. per lb. for carload lots, 10c. for ton lots and 12.50c. for small quantities. Carbon-free, 25 per cent ferrotitanium, is quoted at 35c. per lb.

British Steel Market

American Sheet Bars Sold for Early Delivery—Further Export Prohibitions

LONDON, ENGLAND, Aug. 1, 1916.—(By Cable.)

The pig-iron tightness is acute. French demands are urgent. American sheet bars have sold at £13 5s. c.i.f. for August and September delivery. Four-in. billets are quoted by American makers at \$62 to \$63. Exports have been prohibited of galvanized sheets, cotton ties, cast-iron pipe and steel plates and sheets. Tin plates are lifeless.

The by-product market shows little change. In July benzol advanced a trifle and 90 per cent is quoted at 1s. ½d. Toluol is quoted at 2s. 3d. and solvent naphtha is nominal at 1s. 10d. to 2s. Ammonium sulphate is £16 5s. per ton.

Iron and steel quotations, chiefly nominal, are as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 28s. to 29s.
Steel black sheets, No. 23, export, f.o.b. Liverpool, £20.
Steel ship plates, Scotch, delivered local yards, £13 17s. 6d.
Steel rails, export, f.o.b. works port, £10 17s. 6d.
Hematite pig iron, f.o.b. Tees, about 140s.
Sheet bars (Welsh) delivered at works in Swansea Valley, £10 7s. 6d.
Steel bars, export, f.o.b. Clyde, £18.
Ferromanganese, £35.
Ferrosilicon, 50 per cent, c.i.f., £29.

Ministry of Munitions Makes Official Iron and Steel Prices Actual

(By Mail)

LONDON, July 18, 1916.

The intense pressure of activity in the British iron and steel industry continues, the dominant factor being the vast outlet for the various descriptions of material needed for munitions. The full effect of requirements in that direction is doubtless now being felt, and is likely to be for an indefinite period, and under the circumstances merchant business in the home trade and for export is being whittled down to insignificant dimensions. Manufacturers are crowded with orders sufficient to absorb the great bulk of their output over the remainder of the year, and therefore have very little to sell.

Clear evidence of the dearth of supplies was afforded by the result of the Birmingham quarterly meeting, where buyers were pretty fully represented, but no important fresh features were disclosed. The tendency of steel prices proved as strong as ever, the scarcity showing not the least sign of abatement, and seriously hindering operations at the sheet mills, including galvanized iron and tin plates. It is hoped by tin plate makers that the abstention of buyers will not last much longer, for the requirements of food packers on Government account should again be on the increase shortly.

All descriptions of semi-finished steel are very scarce. Whereas, business in Welsh bars was recently done at various prices ranging up to £14 10s., delivered

locally, the official price still remains at £10 7s. 6d., which also applies to billets, and the authorities insist that this rate must be accepted by makers. The tendency of prices for American material has been rather easier, offers now being made at \$63 down to \$61, c.i.f. Liverpool, but business is slow to mature.

There is no change in the position of pig iron, which remains very tight, producers having hardly anything to spare. Deliveries of Cleveland iron to home consumers have been more liberal, and new French demands are being met a little more freely against permits. The export price is now 97s. 6d. f.o.b. for No. 3. Hematite has continued strong at recent rates, and there is a big demand, while good quantities are being sent to France against running contracts. There has been a renewed advance in the price of rubio ore owing to the labor troubles at Bilbao.

Business in ferromanganese has been much quieter, but the tone is very steady, owing to the difficulty of placing new orders for this year's shipments. Manganese ores are slow, consumers being fairly well supplied.

SCHEDULE OF MAXIMUM PRICES

The Ministry of Munitions, by placing iron and steel under the defense of the real act, are clearly resolved that the farce of declaring official prices which are disregarded shall end. As intimated above, makers of sheet bars and billets are now buying at the official rates, and it may be well, therefore, to detail the actual operative prices for leading classes of material now being enforced:

Maximum Prices for Pig Iron

	Per Ton Net, f.o.t. Makers' Works
Hematite pig iron, East Coast, Scotch and Welsh.	£6 2s 6d
Hematite pig iron, West Coast.	£6 7s 6d
Cleveland pig iron, No. 1.	£4 11s 6d
Cleveland pig iron, other grades.	£4 7s 6d

Maximum Basis Prices for Steel

	Per Ton Net, f.o.t. Makers' Works
Ship plates, ¼ in. and over.	£11 10s 0d
Boiler plates.	£12 10s 0d
Subject to extras for special thickness, sizes and qualities not exceeding those customary in district of manufacture.	
Angles, ordinary sizes.	£11 2s 6d
Joists, ordinary sizes.	£11 2s 6d
Rails (railroad), over 60 lb. per yard.	£10 17s 6d
Sheet and tin plate bars.	£10 7s 6d
Blooms and billets, ordinary mild steel.	£10 7s 6d
Blooms and billets, special.	£11 0s 0d
Rounds and squares, 3 to 5½ in. diameter or square (untested).	£12 10s 0d

Tees, channels, flats, bulb angles, zees and other sections of which the prices are customarily based on the price of angles, to be at price of angles, subject to extras not exceeding those published in any list recognized by the trade in the district of manufacture and current on the 7th day of July, 1916.

All subject to extras for special sizes and qualities not exceeding those published in any such list as above.

Heavy steel, melting scrap. £5 10s per ton deld. buyers' works
Turnings and borings. £2 15s per ton deld. buyers' works

Maximum Price for Bar Iron

Standard quality, ordinary sizes and merchants' lengths, £13 15s per ton net, f.o.t. makers' works.
Marked bars, £15 per ton, less 2½ per cent, f.o.t. makers' works.

Subject to extras for special sizes and qualities not exceeding those published in any such list as above.

To the above mentioned prices for bar iron and steel a sum not exceeding 2½ per cent on such prices may be added in the case of sales by persons other than the makers.

Maximum Prices for High-Speed Tool Steel

Finished bars, 14 per cent tungsten,	2s 10d per lb. delivered buyers' works
Finished bars, 18 per cent tungsten,	3s 10d per lb. delivered buyers' works
(Subject to usual extras for special sizes)	

Scrap:

Millings and turnings, 5d per lb. net, delivered steel makers' works.
Bar ends, 6d per lb. net, delivered steel makers' works.

The Ashland Iron & Mining Company, Ashland, Ky., is now represented in New York City by Morris H. Smith, 298 Avenue A, for the sale of blue annealed, black and galvanized sheets, and all painted and galvanized roofing and metal shingles.

Iron and Industrial Stocks

NEW YORK, Aug. 2, 1916.

A week ago the stock market appeared to have struck a good gait upward, but conditions have since changed and some recessions in values have occurred. The splendid showing of earnings made by the United States Steel Corporation had apparently no effect in stimulating speculation. Instead of this, the pressing for sale of bonds and of some stocks from Europe had a greater influence, while added to this were reports of damages to growing crops through extreme heat in important grain producing sections of the West. The possible culmination of labor troubles on the railroad systems of the country within the next few days may also have had something to do with the curbing of speculation. Favoring the so-called war stocks was the announcement of further contracts for high explosive shells which will add materially to earnings. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Allis-Chal., com.	21 - 22½	Ry. Stl. Spring, com.	42¾ - 43½
Allis-Chal., pref.	73 - 74½	Republic, com.	46¾ - 47¾
Am. Can., com.	53¾ - 56½	Republic, pref.	109¾ - 110
Am. Can., pref.	110 - 110¾	Sloss, com.	42¾ - 44¾
Am. Car & Fdy., com.	55¾ - 59¾	Pipe, com.	19¾ - 20¾
Am. Car & Fdy., pref.	116¾ - 117	Pipe, pref.	53 - 54¾
Am. Loco., com.	63¾ - 69¾	U. S. Steel, com.	85¾ - 87
Am. Loco., pref.	101 - 101¾	U. S. Steel, pref.	116¾ - 118¾
Am. Steel Fdries. 49	- 53½	Va. I. C. & Coke	41 - 42
Bald. Loco., com.	68¾ - 72½	Westing. Elec.	54¾ - 58
Beth. Steel, com.	439½ - 440	Am. Rad., com.	390 - 395
Colo. Fuel.	43¾ - 45½	Am. Ship, com.	43¾ - 44
Deere & Co., pref.	90½	Am. Ship, pref.	90 - 90½
Gen. Electric.	167½ - 169¾	Chic. Pneu. Tool.	67½ - 68¾
Gt. No. Ore Cert.	34¾ - 35¾	Lake Sup. Corp.	10 - 10¾
Int. Harv. of N. J., com.	114	Warwick	9½
Int. Harv. of N. J., pref.	120	Cruc. Steel, com.	66¾ - 70
Int. Harv. Corp., com.	78½	Cruc. Steel, pref.	114¾ - 116
Int. Harv. Corp., pref.	108½	Harb.-Walk, Refrac.	102½ - 103
Lacka. Steel.	70 - 71½	La Belle Iron, com.	52½ - 53
Nat. En. & Stm., com.	22½ - 23½	La Belle Iron, pref.	129¾
N. Y. Air Brake.	123 - 129	Am. Brit. Mfg., com.	12 - 25
Pitts. Steel, pref.	98 - 98¾	Am. Brit. Mfg., pref.	43 - 58
Pressed Stl., com.	47 - 49½	Driggs-Seabury	98½ - 100
Pressed Stl. pref.	100½	Midvale Steel	61 - 62¾

Dividends

The Scovill Mfg. Company extra, 10 per cent, payable Aug. 1. Including this dividend the company has paid 62 per cent thus far in 1916.

The American Brass Company, regular quarterly, 1½ per cent and extra 3½ per cent, payable Aug. 15.

The American La France Fire Engine Company, regular quarterly 1 per cent on the common stock, payable Aug. 15.

The Inland Steel Company, regular quarterly 2 per cent, payable Sept. 1.

The Pressed Steel Car Company, regular quarterly 1½ per cent on the preferred stock, payable Aug. 23, and the resumption of dividends on the common stock by the payment of 1 per cent Sept. 6.

The United Engineering & Foundry Company, regular quarterly, 2 per cent on the preferred stock and an increase in the quarterly dividend on the common stock to 3 per cent.

Japanese to Work a Chinese Iron Mine

Negotiations which have been proceeding since 1914 with the Chinese authorities by the Sino-Japanese Industrial Development Company have recently been concluded and the rights to work the Taochung iron mine at Taochung, Fanchang-Hsien, China, have been definitely conceded. The mine is reported to contain 60,000,000 tons of ore, averaging 65 per cent iron, against 60 per cent usually found in the Tayeh ores, from which the Hanyang furnaces are supplied.

Canada's foreign trade in the three months ended June 30 totalled \$527,512,344, against \$272,646,868 for the corresponding quarter of 1915. The imports rose from \$98,017,187 to \$186,245,480, and the domestic exports from \$113,578,221 to \$245,381,035. Foreign exports increased from \$8,577,775 to \$66,989,732. June contributed largely to the good showing for the quarter, the increase in the trade total being from \$127,402,516 in June, 1915, to \$243,953,544 in June this year.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, effective from April 10, 1916, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30.7c.; Birmingham, Ala., 45c.; Pacific coast (by rail only), 65c.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 2.50c. to 2.75c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs.	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909.	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail).	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909.	.20 to .80
Deck beams and bulb angles.	.30
Handrail tees.	.75
Cutting to lengths, under 3 ft. to 2 ft. inclusive.	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive.	.50
Cutting to lengths, under 1 ft.	1.55
No charge for cutting to lengths 3 ft. and over.	

Plates.—Tank plates, ¼ in. thick, 6 in. up to 100 in. wide, 2.90c. to 4c., base, net cash, 30 days, or ½ of 1 per cent discount in 10 days, carload lots. Extras are:

Quality Extras	Cents per lb.
Tank steel	Base
Pressing steel (not flange steel for boilers)	.10
Boiler and flange steel plates	.15
"A. B. M. A." and ordinary firebox steel plates	.20
Still bottom steel	.30
Locomotive firebox steel	.50
Marine steel, special extras and prices on application.	

Gage Extras	Base
Rectangular, ¼ in. thick, over 6 in. wide to 100 in. wide.	.10
Lighter than ¼ in., to 3/16 in., up to 72 in. wide.	.20
*Lighter than ¼ in., including 3/16 in., over 72 in. to 84 in.	.30
*Lighter than ¼ in., including 3/16 in., over 84 in. to 96 in.	.40
*Lighter than ¼ in., including 3/16 in., over 96 in. to 100 in.	.45
*Lighter than 3/16 in., including No. 8, up to 72 in. wide.	.15
*Lighter than 3/16 in., including No. 8, over 72 in. to 84 in.	.25
*Lighter than 3/16 in., including No. 8, over 84 in. to 96 in.	.35
*Lighter than No. 8, including No. 10, up to 60 in. wide.	.30
Lighter than No. 8, including No. 10, over 60 in. to 64 in.	.35
Up to 72 in., not less than 10.2 lb. per sq. ft. will be considered ¼ in.	
Over 72 in. must be ordered ¼ in. thick on edge, or not less than 11 lb. per sq. ft. to take base price.	
Over 72 in. wide, ordered less than 11 lb. per sq. ft., down to weight of 3/16 in., take price of 3/16 in.	
Over 72 in., ordered weight 3/16 in., take No. 8 price.	
Over 72 in., ordered weight No. 8, take No. 10 price.	

Width Extras	
Over 100 in. to 110 in. inclusive.	.05
Over 110 in. to 115 in. inclusive.	.10
Over 115 in. to 120 in. inclusive.	.15
Over 120 in. to 125 in. inclusive.	.25
Over 125 in. to 130 in. inclusive.	.50
Over 130 in.	1.00

Length Extras	
Universal plates 80 ft. long up to 90 ft. long.	.05
Universal plates 90 ft. long up to 100 ft. long.	.10
Universal plates 100 ft. long up to 110 ft. long.	.20

Cutting Extras	
No charge for rectangular plates to lengths 3 ft. and over	
Lengths under 3 ft. to 2 ft. inclusive.	.25
Lengths under 2 ft. to 1 ft. inclusive.	.50
Lengths under 1 ft.	1.55
Circles 3 ft. in diameter to 100 in.	.30
Circles over 100 to 110 in. (width extra)	.35
Circles over 110 to 115 in. (width extra)	.40
Circles over 115 to 120 in. (width extra)	.45
Circles over 120 to 125 in. (width extra)	.55
Circles over 125 to 130 in. (width extra)	.80
Circles over 130 in. (width extra)	1.30
Circles under 3 ft. to 2 ft. inclusive.	.55
Circles under 2 ft. to 1 ft. inclusive.	.80
Circles under 1 ft.	1.85
Half circles take circle extras.	
Sketches, not over four straight cuts, inc. straight taper	.10
Sketches having more than four straight cuts.	.20
Plates sheared to a radius take complete circle extras.	

*Including extra for width.

Wire Rods.—Including chain rods, \$55 to \$60.

Wire Products.—Prices to jobbers effective May 1: Fence wire, Nos. 6 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, \$2.45; galvanized, \$3.15. Galvanized barb wire and staples, \$3.35; painted, \$2.65. Wire nails, \$2.50 to \$2.60. Galvanized nails, 1 in. and longer, \$2 advance over base price; shorter than 1 in., \$2.50 advance over base price. Cement-coated nails, \$2.50. Woven wire fencing, 61½ per cent off list for carloads, 60½ off for 1000-rod lots, 59½ off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.									
Nos.	6 to 9	10	11	12	12½	13	14	15	16
Annealed	\$2.50	\$2.55	\$2.60	\$2.65	\$2.75	\$2.85	\$2.95	\$3.05	
Galvanized	3.20	3.25	3.30	3.35	3.45	3.55	4.00	4.10	

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect on black pipe from April 21, 1916, and on galvanized from July 24, 1916, all full weight pipe:

Butt Weld					
Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
1½, 2 and 3	63	55½	1½ and 2	52	24
1½ to 3	67	51½	2 to 3	53	25
3 to 3	70	55½	3 to 4	57	38
			4 to 1½	60	43
Lap Weld					
2	65	50½	1½	48	31
2½ to 6	68	53½	2	54	38
7 to 12	65	49½	2½	55	39
13 and 14	53½		3 to 4	57	42
15	51		4½ to 6	57	42
			7 to 12	56	41
Reamed and Drifted					
1 to 3, butt	68	53½	¾ to 1½, butt	55	37
2, lap	63	48½	1½, lap	43	25
2½ to 6, lap	66	51½	1½, lap	49	32
			2, lap	50	33
			2½ to 4, lap	52	36

Butt Weld, extra strong, plain ends					
1½, 2 and 3	59	40½	1½, 2 and 3	52	34
1½ to 3	64	50½	1½ to 3	57	43
3 to 1½	68	54½	¾ to 1½	61	45
2 to 3	69	55½			
Lap Weld, extra strong, plain ends					
2	63	49½	1½	50	33
2½ to 4	66	52½	2	55	39
4½ to 6	65	51½	2½	57	42
7 to 8	61	45½	3 to 4	59	45
9 to 12	56	40½	4½ to 6	58	44
			7 to 8	52	38
			9 to 12	47	33

Butt Weld, double extra strong, plain ends					
1½	55	43½	1½	44	31
¾ to 1½	58	46½	¾ to 1½	47	34
2 to 2½	60	48½			

Lap Weld, double extra strong, plain ends					
2	55	43½	1½	44	30
2½ to 4	57	45½	2	44	30
4½ to 6	56	44½	2½ to 4	46	35
7 to 8	51	35½	4½ to 6	45	34

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Sheets.—Makers' prices for mill shipments on sheets of U. S. standard gage, in carload and larger lots, are as follows, 30 days net, or 2 per cent discount in 10 days:

Blue Annealed Sheets		Cents per lb.
Nos. 3 to 8		2.95 to 3.20
Nos. 9 and 10		3.00 to 3.25
Nos. 11 and 12		3.05 to 3.30
Nos. 13 and 14		3.10 to 3.35
Nos. 15 and 16		3.20 to 3.45

Box Annealed Sheets, Cold Rolled		
Nos. 17 to 21		2.70 to 2.80
Nos. 22 and 24		2.75 to 2.85
Nos. 25 and 26		2.80 to 2.90
No. 27		2.85 to 2.95
No. 28		2.90 to 3.00
No. 29		2.95 to 3.05
No. 30		3.15 to 3.25

Galvanized Sheets of Black Sheet Gage		
Nos. 10 and 11		3.25 to 3.35
No. 12		3.35 to 3.45
Nos. 13 and 14		3.35 to 3.45
Nos. 15 and 16		3.45 to 3.55
Nos. 17 to 21		3.60 to 3.70
Nos. 22 to 24		3.70 to 3.80
Nos. 25 and 26		3.85 to 3.95
No. 27		4.10 to 4.20
No. 28		4.25 to 4.35
No. 29		4.40 to 4.50

Boiler Tubes.—Discounts on less than carloads, freight to destination added, effective from April 15, 1916, are as follows:

Lap Welded Steel		Standard Charcoal Iron	
1½ in.	.35	1½ in.	.37
1¾ and 2 in.	.47	1¾ and 2 in.	.39
2½ in.	.44	2½ in.	.36
2½ and 2¾ in.	.50	2½ and 2¾ in.	.42
3 and 3¼ in.	.55	3 and 3¼ in.	.47
3½ to 4½ in.	.56	3½ to 4½ in.	.48
5 and 6 in.	.49	5 and 6 in.	.41
7 to 13 in.	.46	7 to 13 in.	.38

Locomotive and steamship special charcoal grades bring higher prices.

1½ in., over 18 ft., and not exceeding 22 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Metal Markets

The Week's Prices

Cents Per Pound for Early Delivery							
Copper, New York		Tin,	Lead—		Spelter—		
		Electro- New	York	New	St. Louis	New	St. Louis
July	Lake	lytic	York	York	Louis	York	Louis
26	25.25	25.00	37.87½	6.10	6.00	10.25	10.00
27	25.50	25.25	37.87½	6.05	6.00	10.25	10.00
28	25.75	25.50	38.25	6.10	6.00	10.00	9.75
29	26.00	25.75	...	6.15	6.00	10.00	9.75
31	26.25	26.00	38.25	6.10	6.00	9.75	9.50
AUG.							
1	26.25	26.00	38.00	6.10	6.00	9.50	9.25

NEW YORK, Aug. 2, 1916.

Copper is stronger because of the absorption of resale lots. Tin is practically unchanged in a quiet market. Lead has been fairly active, but prices are lower. Spelter is dull and quotations again show a declining tendency. The dullness in antimony is unbroken and the nominal quotation is lower.

New York

Copper.—The market has continued very slow, but it has a better undertone because of the gradual absorption of metal in second hands. No sales of individual importance are reported, and the producers have confined their activity to filling contracts. There is a general feeling that a change in conditions is not far off, and it probably will come by a revision in producers' prices, thereby inducing the brass mills to buy for the last quarter and beyond. For some months the latter have been operating on metal supplied under contract. The London market for spot electrolytic is stronger at £125 against £122 a week ago. The exports in July reached the excellent total of 35 048 tons. Electrolytic was quoted at New York yesterday at 26c. to 26.25c., cash, and Lake was nominal at 26.25c.

Copper Averages.—The average price of Lake copper for the month of July, based on daily quotations in THE IRON AGE, was 25.84c., and of electrolytic, 25.57c.

Tin.—In its entirety the week has been quiet, although on July 26 a fair business was done. On that day early arrivals sold at 37.62½c. and early shipments from the East in small volume at 36.50c. to 36.75c. On no other day was there noteworthy activity. The supply of Banca is in excess of the need, and it has sold at 37c. for spot delivery. The deliveries into consumption in July totaled 4432 tons, of which 832 tons came to the East from Pacific ports. In stocks and landing July 31 was 5028 tons. There is now afloat 1696 tons. Spot Straits was quoted at New York yesterday at 38c.

Lead.—Of all the metals lead has been the most active, and in the aggregate a fair business was done on both foreign and domestic account. A feature of the week was the fairly large number of inquiries and consequent sales for carload lots wanted promptly, indicating that consumers' reserve stocks have reached a low point. A few large orders were placed. It is the general opinion that consumers will buy at a lively rate and in good quantities if the leading interest reduces its quotation to 6c., New York. It continues to quote 6.50c., New York, and 6.42½c., St. Louis, and declares it is getting orders on that basis. The independents, however, who have been taking most of the business to the exclusion of dealers and second hands, have been selling down to 6.10c., New York, and 6c., St. Louis, the minimum quotations of yesterday. The exports in July totaled 2541 tons.

Spelter.—The market has become very dull and producers' representatives are of the opinion that there will not be any considerable betterment until the brass trade enters the market again. This will not be until they have neared the end of the metal they have under contract. A week ago the tone of the market was such that holders of spelter withdrew offerings and it had every appearance of being scarce, to the distress, more or less, of interests believed to have been short. Since then, however, plenty of the metal has become available and prices have declined. Prompt and August

were quoted yesterday at 9.25c. to 9.50c., St. Louis, and 9.50c. to 9.75c., New York. September was about 9c., St. Louis, and October and November at about 8.75c. Brass mill special is quoted at from 10.50c. to 11c. The exports in July were extremely large, amounting to 7079 tons, representing sales made some time ago. The London market dropped from £60 to £55 yesterday, which had a weakening effect here.

Antimony.—This metal can be had without difficulty at 12.30c., New York, duty paid, but there is little demand. A phase of the situation is that stocks are held in New York which cost the owners over 30c. per pound. Incidentally, the price is getting down to a point where some domestic producers cannot manufacture except at a loss.

Aluminum.—The quotation for ton lots is unchanged at 58c. to 60c. for No. 1 virgin metal, 98 to 99 per cent pure.

Old Metals.—The demand has improved and more activity is reported. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible.....	22.50 to 23.50
Copper, heavy and wire.....	21.50 to 22.50
Copper, light and bottoms.....	18.00 to 19.00
Brass, heavy.....	13.00 to 14.00
Brass, light.....	10.50 to 11.50
Heavy machine composition.....	17.50 to 18.50
No. 1 yellow rod brass turnings.....	13.75 to 14.75
No. 1 red brass or composition turnings.....	14.50 to 15.50
Lead, heavy.....	5.75
Lead, tea.....	5.25
Zinc.....	7.00 to 8.00

Chicago

JULY 31.—On the strength of an active market in copper, prices have held firmly. Electrolytic has been especially strong. Tin quotations were higher at the end of last week, but lead quotations from independent sources displayed more pronounced weakness. We quote: Casting copper, 24.50c. to 25c.; Lake copper, 26c.; tin, carloads, 39.25c., and small lots, 40.50c.; lead, 6.05c. to 6.45c.; spelter, 9.50c. to 9.75c.; sheet zinc, 15c.; Cookson's antimony, 50c.; other grades, 15c. to 16c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 17.75c.; copper bottoms, 15.75c.; copper clips, 16.75c.; red brass, 15.50c.; yellow brass, 11.50c.; lead pipe, 4.50c.; zinc, 5c.; pewter, No. 1, 27c.; tinfoil, 27c.; block tin pipe, 32c.

St. Louis

JULY 31.—Metals have been quiet with quotations closing to-day as follows: Lead, 6.25c prompt and 6.12½c August; spelter, nominal, 9.50c to 9.75c; tin, 40c; Lake copper, 26c; electrolytic copper, 25.50c; antimony, 13.50c to 14c. In the Joplin ore district the range on zinc blende was from \$55 to \$75 for 60 per cent, with the average for the week \$66 per ton. Calamine sold on a basis of \$40 to \$50 for 40 per cent with the average \$44. Lead ore sold at \$70 for 80 per cent metal with the week's average \$72 because of premiums. Many producers are now holding their ore, while dry weather is affecting some of the mines which need water for operation. On miscellaneous scrap metals we quote dealers' buying prices as follows: Light brass, 7.50c.; heavy yellow brass, 10.50c; heavy red brass and light copper, 14.50c; heavy copper and copper wire, 17c; pewter, 25c; tinfoil, 30c; lead, 5c; zinc, 4.50c; tea lead, 3.50c.

The property of the Nova Scotia Car Works, Halifax, was sold at auction July 26 by the liquidator, the purchaser being F. B. McCurdy. It is understood the old security holders will be afforded the opportunity of protecting their investment by joining in the contemplated reorganization if they wish to do so, and the property will be offered to them at the cost price. The price at which it was purchased—\$167,500—is subject to a mortgage of \$115,000 held by the city of Halifax.

Railroad shipments from Archangel to the interior of Russia are averaging 300 to 400 cars a day, according to Commercial Attache Henry D. Baker, Petrograd. On some days as many as 1000 cars have left the port. The line to Vologda is now broad gage, so that 14-ton cars are possible against 10-ton cars last year on the narrow-gage line then existing, and freight shipments are thus made to all parts of Russia without change of cars.

PERSONAL

Capt. H. M. M. Richards has resigned as treasurer of the American Iron & Steel Mfg. Company, Lebanon, Pa., and the duties of treasurer will be added to those of Daniel G. Scott, secretary. Charles B. Foster, Jr., assistant secretary, has also resigned.

George M. Hendee has resigned as president and director of the Hendee Mfg. Company, Springfield, Mass. He is succeeded by John F. Alvord, president of the Torrington Company and its associated enterprises. The stock interest of Mr. Hendee, a minority interest, has been secured by Mr. Alvord and his associates. Mr. Hendee had been desirous of retiring from his industrial activities for some time, but had not before found an opportunity to retire without injury to the company. Charles N. Kinckley, secretary of the company, has resigned to accept a position with the Willys-Overland Company, Toledo, Ohio.

John A. Hunter, who has for some years been steam engineer of the American Sheet & Tin Plate Company, Pittsburgh, has also been placed in charge of the welfare department.

Charles Pascoe, former metallurgist for the Canadian Steel Foundries, Ltd., and recently connected with the Thomas Davidson Mfg. Company, Ltd., Montreal, as consulting metallurgist, has joined the Snyder Electric Furnace Company, Chicago, as metallurgist in that company's electric furnace research plant, at Clearing, Ill. Mr. Pascoe's work in connection with the Thomas Davidson Mfg. Company had to do with the production of shell billets from a Snyder electric acid steel furnace, and his work in this connection has been peculiarly successful, as evidenced by the fact that approximately 90 per cent of the billets passed inspection. Douglas Walker, former salesman for the Electric Furnace Company and in charge of the Chicago district, has been appointed sales manager.

Willard A. Van Brunt, Horicon, Wis., farm implement and machinery manufacturer, has presented the Grand Lodge of Wisconsin, Free and Accepted Masons, with \$200,000 in first mortgage farm securities as an endowment fund for the maintenance of the Masonic home, at Dousman, Wis., for which in 1905 he presented a 319-acre farm and buildings, now valued at \$155,000.

W. R. Hulbert, sales manager of the Goldschmidt Thermit Company, New York, delivered an illustrated lecture, supplemented with demonstrations, to the members of the Clinchfield Railway Club, Erwin, Tenn., on Tuesday evening, July 25.

H. B. Coleman has been appointed sales manager of the Russell & Erwin Mfg. Company, New Britain, Conn. He was formerly with this company for a number of years, but recently has been with the T. B. Rayl Company, Detroit, Mich.

The Titanium Alloy Mfg. Company, Niagara Falls, N. Y., has recently added to its bronze department sales force Gilbert T. Mason, formerly secretary and treasurer of the Atkinson Company, Rochester, N. Y. Its business is expanding rapidly and in keeping with its policy of service finds it necessary to increase its organization.

Frank G. Bolles, formerly manager of *International Trade*, an export publication, at Chicago, has been made vice-president of the Russian Trade Corporation of America and will have charge of its business. This is a subsidiary company formed by R. Martens & Co., Inc., New York, and its offices will be in the Maritime Building, 8 and 10 Bridge Street, New York. Offices of the Russian Trade Corporation have also been opened in several of the large commercial centers of Russia. The Russian trade operations of R. Martens & Co., Inc., are limited to mechanical lines, while those of the new company will be in non-mechanical lines.

Lieut.-Col. H. A. Johnson, senior director of the wire manufacturing company of Richard Johnson & Nephew, Ltd., Bradford Iron Works, Manchester, Eng-

land, was wounded at the front in France early in July and is now in a hospital in London. He was in command of the 17th Battalion Manchester Regiment and was leading an attack on Montauban. The firm of Richard Johnson & Nephew, Ltd., has been known in the United States for some years, having been licensed by the Washburn & Moen Company in 1877 for the manufacture of Glidden barb wire fence and having installed the first continuous wire-rod rolling mill in England.

Earl McIntire, for 17 years connected with the Republic Iron & Steel Company, Youngstown, Ohio, but who resigned recently to take the position of field engineer for the Canadian Steel Corporation at Ojibway, Canada, was presented with a chest of silver by his associates in the Republic company offices, the presentation speech being made by G. C. Shackleford.

Raymond McLaughlin, for 15 years in the offices of the Union works of the Carnegie Steel Company at Youngstown, Ohio, has been appointed secretary to Ward B. Perley, vice-president and general manager of the Canadian Steel Corporation at Ojibway, Canada. He was presented with a handsome stickpin by his associates.

Richard Peters, Jr., has opened offices at 52 Vanderbilt Avenue, New York, as chairman of the Connellsville Coal Tariff Association. This organization was formed recently by leading operators in the Connellsville coking district to present to the railroads the need of a readjustment of freight rates on coal out of that district. With the growth of by-product coke oven installations it will be necessary in the future to ship in place of a portion of the present Connellsville coke output, Connellsville district coal for use in these by-product ovens. The association recently presented its claims for more advantageous rates before an examiner of the Interstate Commerce Commission.

W. G. Savage, for many years associated with the United States Cast Iron Pipe & Foundry Company at its Chicago office, has been made assistant Western sales manager.

Advanced Safety Code for Foundries

The American Foundrymen's Association Safety Committee which met at Rochester, July 20 and 21, is made up as follows: Victor T. Noonan, director of safety, Industrial Commission of Ohio, Columbus, chairman; Earl B. Morgan, safety engineer, Norton Company, Worcester, Mass.; F. H. Elam, manager casualty department, American Steel Foundries, Chicago; George B. Koch, general foreman, South Altoona Foundries, Altoona, Pa.; Ralph H. West, president West Steel Castings Company, Cleveland, Ohio; C. E. Pettibone, chief safety inspector, Pickands, Mather & Co., Cleveland, and Dr. Richard Moldenke, Watchung, N. J.

All were present at Rochester except Mr. Pettibone. Other participants in the conference were F. Will, Sr., president, and Thomas A. Soultis, superintendent, Sill Stove Works, and Joseph E. McHenry, superintendent Gleason Works Foundry, Rochester. Chairman Noonan believes that the recommendations adopted at Rochester, which follow in many particulars the Ohio foundry code, represent the most progressive steps along safety lines that have yet been taken up in industrial organizations, and also expresses the opinion that they will go far toward bringing about better relations between foundry workmen and employers. The committee report, which will be presented to the Cleveland convention of the American Foundrymen's Association in September, contains many reforms for which workmen have been contending. These were adopted with unanimity by the committee, though none of its members represents organized labor.

Great Britain's manganese ore imports in June were 50,826 gross tons against 42,068 tons in May. This brings the total imports to July 1, 1916, to 225,492 tons, against 134,526 tons in the first six months of 1915. In 1914 and 1913 these imports were 39,953 and 50,098 tons per month respectively.

Pittsburgh and Nearby Districts

Blast-furnace operators in the Youngstown district have decided to pay the railroad charge of 20c. per ton approved by the Interstate Commerce Commission for hauling away furnace slag. The money will be paid to the railroads under protest until the question is finally settled. The railroads announced recently that they would haul no more slag after Aug. 1 without assurance from the furnace operators that they would be paid for the service. A blast furnace making 500 tons of pig iron per day will make about 250 tons of slag. With a total of 22 furnaces in the Youngstown district, this means that 5500 tons of slag will have to be hauled away every day at a charge of 20c. per ton. Some of the furnace operators declare they will arrange to dump their slag near the furnaces.

The Foreign Trade Commission of Pittsburgh reports very heavy export inquiries for iron and steel in various forms. In one day it received inquiries from London for 7400 tons of 60-lb. rails, 5500 tons of steel railroad ties, 210 tons of fish plates, 48 tons of nuts and bolts, 1200 tons of 3/16-in. wire and 90 tons of cable; from Italy an inquiry for a large quantity of brass rods, and from Russia an inquiry for two crankshafts.

The Penn Iron & Steel Company, Peterson, Pa., recently organized, plans to build a plant to manufacture bar-iron products.

The American Pattern Mfg. Company, Youngstown, Ohio, has been organized to make patterns for foundries. Identified with the new company are S. S. French, general manager of the William Tod Company; Harry M. Kelly, manager of the Lloyd Booth department of the United Engineering & Foundry Company; Gerald F. Hamilton and B. M. Campbell, all of Youngstown, and Edmund Collins, formerly connected with a pattern works at Sharon, Pa. The company will occupy buildings on Wilson Avenue, Youngstown.

The cooling system in use in the plants of the American Sheet & Tin Plate Company at Sharon, and Farrell, Pa., has proved very satisfactory during the recent excessively hot weather. It is said the men were thus enabled to work longer hours and to turn out more product than in other plants not so equipped. The system was invented by W. H. Davis, superintendent of the company's tin-plate mills at Farrell.

Fred H. Merrick, the leader in the Westinghouse strikes and in the riots at Bessemer, Pa., early in May, and who was sentenced to three years and six months in the workhouse, has been released on \$10,000 bail, pending the disposition of an appeal which has been taken to the Superior Court.

The Carnegie Steel Company, Pittsburgh, is in the market for a 24-in. open-gap, double-end, motor-driven, combination punch and shear for its Ohio works, to punch 7/8-in. holes through 3/4-in. plate, and a bar shear for its Duquesne works.

The Valley Forging Company, Oakmont, Pa., is in the market for a motor-driven shear.

Referring to the increase in the capital stock of the Pennsylvania Tank Car Company, Sharon, Pa., from \$500,000 to \$1,000,000, it is stated by L. F. Jordan, president, that none will be issued in the near future. The company does not now contemplate making any additions to its plants.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, denies that it has received an order for 50,000 tons of barb wire for shipment to Russia, although it is filling several smaller orders for such shipment.

In the near future Youngstown will be a large producer of benzol. The Republic Iron & Steel Company has been a maker of benzol since its by-product coke plant was completed in December last year, and the Youngstown Sheet & Tube Company and the Brier Hill Steel Company are also erecting benzol plants, both of which will be in operation before the end of the year.

The Zug Iron & Steel Company, which was one of the oldest bar-iron manufacturers in the Pittsburgh district, but which has not been active for some years, has sold its property to an unknown buyer. Reports that it had been sold to the American Steel & Wire Company

and would be used in making large additions to the latter's Shoenberger works have been officially denied.

The Brier Hill Steel Company is adding to its open-hearth steel plant at Youngstown, Ohio, one additional soaking-pit furnace, which is being built in line with the others, making six in a row.

The Baldwin Tool Works, Parkersburg, W. Va., has bought the Ruschaupt canning factory building at Princeton, Ind., and will equip it for the manufacture of handles.

The new plant which the Standard Car Construction Company is erecting at Masury, near Sharon, Pa., will use electric power throughout. A contract has been made with the Mahoning & Shenango Railway & Light Company to furnish the power, the equipment to include two motor generator sets with 22-hp. motors, four 58-hp. motors for the air compressors, four 75-hp. motors for the hydraulic riveters and other machinery and a large number of smaller motors for various purposes. The three large steel buildings are nearly completed and the installation of equipment will start in a short time, all contracts having been placed.

The Stevens Metal Products Company, Niles, Ohio, recently organized, will manufacture a line of metal products, including straight side drums of practically all standard capacities. E. D. Thompson, for some years with the Metal Post & Culvert Company, Niles, will resign Aug. 8 to become vice-president of the Stevens Company.

The Edgewater Steel Company, Pittsburgh, has made application for a Pennsylvania charter with a nominal capital of \$5,000.

The Jamison Coal & Coke Company, Pittsburgh, which operates extensively in the Fairmont coal mining district in West Virginia, has sold 1500 steel hopper cars to the Baltimore & Ohio Railroad, subject to unexpired equipment trusts amounting to \$600,000.

Thomas L. Brown has been appointed temporary receiver for the Safety Armorite Conduit Company, the Garland Nut & Rivet Company, the West Penn Realty Company and the Garland Corporation of Pittsburgh. The last-named company is a holding concern for the others. The plants of the Safety Armorite Conduit Company and the Garland Nut & Rivet Company are located at West Pittsburgh, near New Castle, Pa. Bills in equity had been filed against all four companies in which the appointment of a receiver was asked to take over their affairs for the purpose of saving the assets from being wasted through legal proceedings on the part of pressing creditors.

The Petroleum Iron Works Company, Sharon, Pa., has acquired a site of 66 acres adjacent to its present plant, which will be utilized for extensions. Plans are under consideration for very large additions.

All of the 10 furnaces in the zinc plant of the American Steel & Wire Company at Donora, Pa., are now in full operation, turning out between 3000 and 3500 tons of zinc per month. The plant is also making sulphuric acid, and when this department is in full operation it will turn out 100,000 tons of acid per year.

Ohio Sheet Metal Contractors' Meeting

The Master Sheet Metal Contractors' Association of Ohio held its annual convention in Cincinnati July 25, 26 and 27. About 150 active members were present. In addition to various trade matters that came up for discussion, the question of closer co-operation with the mills in their efforts to improve their materials received deep consideration.

The following officers were elected to serve the ensuing year: President, F. J. Hoersting, Dayton; vice-president, John Weigel, Cincinnati; secretary, W. J. Kaiser, Columbus; treasurer, W. J. Birmingham, Cleveland. The next annual meeting will be held in June, 1917, in Cleveland at the same time that the National Association of Sheet Metal Contractors will meet in that city.

The Japanese steamer Tatsuno Maru, which left Seattle recently, carried 5000 tons of steel plates, angles and bars consigned to Japanese shipbuilding yards.

OBITUARY

JOHN HAMILTON BROWN, consulting engineer of the Maxims Munitions Corporation, died July 25 at his home in West Hoboken, N. J., aged 79 years. He was born in Maine and became an inventor at the age of 20. Among his inventions were machines for shoe making, quilting lace, making automobile tire valves and for wire making. He was the inventor of the wire wound gun tested by the Government in 1905. He had designed a new military rifle for the Maxims Munitions Corporation. He was a champion rifle shot. The American team of sharpshooters, which defeated a British team at the famous Wimbledon match in 1883, used a rifle of his invention.

FREDERICK C. GEDGE died July 28 in Chicago, aged 59 years. He was one of the early manufacturers of wire nails, having been vice-president of the American Wire & Nail Company, which was merged in the American Steel & Wire Company. At the time of his death Mr. Gedge was district manager of the plants of the American Steel & Wire Company in the Chicago district, having entire charge of operations. He was also vice-president of the Gedge Brothers' Iron Roofing Company, Anderson, Ind., and had other personal business interests. He was born in Covington, Ky., and was there buried. He leaves his widow and six children.

HOWARD MACRUM, general superintendent of the Lakeside and Riverside works of the Otis Steel Company, Cleveland, died suddenly July 27, of acute indigestion, aged 48 years. He had worked his way up from a minor position in the operating department of the National Tube Company at its McKeesport works and went to the Otis Steel Company in 1903 as superintendent of its plate mill. Shortly after the completion of the company's new Riverside works he was put in charge of both plants.

JOHN H. ALLEN, of New York City, died July 22 at his summer home, Kattskill Bay, Lake George, N. Y., aged 57 years. For the last 15 years he had been president of the John F. Allen Company, 370-372 Gerard Avenue, New York, maker of the original Allen riveting machines. Mr. Allen succeeded his father, who founded the business some 45 years ago. He had long been an active member of the Bronx Board of Trade, New York City.

JUDSON H. BOUGHTON, president Great Lakes Boat-building Company, Milwaukee, Wis., died July 29 of burns received a few days previously when a power boat in which he was cruising on Lake Michigan caught fire. He removed to Milwaukee from St. Louis Jan. 1 last, when St. Louis interests purchased the Milwaukee Yacht & Boat Company and transferred the headquarters of a large boat syndicate to Milwaukee. He was 37 years old and leaves his widow and two children.

GEORGE H. CAREY, assistant treasurer, William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., died suddenly July 22 at his home in that city, aged 64 years. For about 25 years Mr. Carey had served his company as purchasing agent and in that position won a reputation for fair and conscientious dealing and made for himself innumerable friends. About five years ago he was made assistant treasurer. He leaves his widow and one son.

JOHN T. BURR, Brooklyn, N. Y., died July 27, aged 76 years. He was born in New York City, was graduated from Columbia University in 1861, served through the Civil War and subsequently founded the firm of John T. Burr & Son for the manufacture of machinery, whose establishment is now located at 429 Kent Avenue, Brooklyn. He leaves a son, William Burr, and three daughters.

F. WOLFF, well known in the iron and steel industry of Portland, Ore., having been for 12 years general superintendent of the Phoenix Iron Works, died July 13, aged 74 years. He was a native of Germany, locating in San Francisco in 1869 and in Portland two years later.

STRIKES AND SETTLEMENTS

Milwaukee Shops Still at Work

MILWAUKEE, Aug. 1.—(By *Telegraph*).—Leaders of the machinists claim a total of 2739 men now out. Workmen in three plants struck on Monday and to-day namely, Power & Mining Machinery, Union Electric and Gemco Mfg. companies. Every shop affected is at work, although operations are somewhat reduced by walkouts. Murmurings are heard in strikers' ranks over the conduct of the strike. Bad management and unpreparedness are charged against the leaders. It is claimed that no strike benefits have yet been received, resulting in the return to work of a considerable number. The Metal Trades and Founders' Association has made no further announcements and is standing firm.

Mail advices state that 18 plants had been involved in the strike when union agitators called a halt for the week on Friday night. Disorder in the strike up to this time has been rare. There have been a few arrests, but in each instance the union agitators insist that the offender was not a member of the machinists' organization. Pickets have been at work throughout the week, and union leaders say that lines will be drawn tighter the coming week. An irritating feature of the situation is the report of walkouts by strike leaders when the facts do not bear out the statements. The city, like most of the Middle West, has been suffering under a spell of the hottest weather known in years, and numerous plants have been compelled, for humanitarian purposes, to shut temporarily. Some of these instances have been used by strike leaders as examples of their members being shut out because of anticipation of a walkout.

The Milwaukee Tank Works on Friday announced that it had voluntarily granted its force a 9-hr. work-day. The company employs few machinists and is not a member of the employers' association.

Andrew Kopperud, operating a small shop, offered a 50-hr. week at the former 55-hr. week pay, which was accepted.

Bonuses at Youngstown

The Youngstown Sheet & Tube Company, Youngstown, has notified salaried employees who did not participate in the wage advance which went into effect May 1 that they will be given a bonus of 10 per cent on their total earnings during the first half of 1916. A general readjustment of salaries has been made by this company to a higher basis for the last half of the year.

The Banner Electric Company, Youngstown, has notified 55 of its employees who have been with the company for five years or more of a bonus of 5 per cent in their earnings for the first half of the year, which has already been paid. The amount was about \$1,200, distributed among 14 male and 41 female employees.

The Strike at the Fluorspar Mines

The strike at the mines of the Fairview and Rosiclaire companies in Illinois, from which approximately 75 per cent of the fluorspar production of the country is obtained, holds out no promise of an immediate settlement. The operators claim to have no alternative in the matter of granting the increased wages asked by the miners except as they may be able to sell their product at correspondingly higher prices. At one of the properties the decision has been reached to pull the pumps and cease operations. The other mine will attempt, for the time being at least, to operate its pumps and keep the mine from flooding, but ability to secure the necessary labor for even this week is questionable.

The selling representatives of these properties have advised their trade to purchase, whenever offered, the scattered lots of fluorspar produced from other sources and one such purchase of 1000 tons by a large steel company is reported. While the larger open-hearth plants are understood to have on hand a comfortable supply, there are those who will shortly suffer from the curtailment, as fluorspar has no substitute in open-hearth steel practice. Foundries which are accustomed to use it can, under necessity, substitute a lime flux.

Machinery Markets and News of the Works

REVIVAL OF WAR BUYING

Contractors Buy Hundreds of Lathes

Munitions Makers Also Want Other Tools—One Inquiry Calls for 100 Milling Machines—Canada's Great Activity

Following placing of contracts for large shells valued at millions of dollars orders have been placed for hundreds of engine lathes of 24-in. to 30-in. swing, to be delivered within eight weeks. The E. W. Bliss Company and the American Locomotive Company have been large purchasers of lathes wherewith to execute shell orders, and it is probable that the American Brake Shoe & Foundry Company and other manufacturers will buy, if they have not done so already. Inasmuch as deliveries of lathes can be made within the required time without much difficulty, and because they tend to simplify the labor problem, there is a tendency to use lathes for both the inside and outside work on the shells, despite the fact that large turret lathes afford undeniable advantages.

Chicago reports some figuring on heavy lathes, and this type of machine is active in Cleveland also.

The hot weather in the West has interfered somewhat with production, but the markets in general are active. In the Chicago market there is a notable list of current new factory construction work.

Accompanying the activity in lathes, there also has been a good volume of inquiry for other equipment required by munitions shops. One inquiry received in the East called for 100 milling machines. Under the renewed war demand, deliveries which are easing up a bit are likely to stiffen again.

It is reported from Canada that shell production is falling under expectations in point of quantity. Orders placed in the Dominion are estimated at \$500,000,000.

In Cincinnati, makers of sheet-metal-working machinery are enjoying noteworthy activity. In that city complaint is heard that foundries have fallen behind on deliveries because of the hot weather.

In the Pacific Northwest, labor troubles which have restricted activity are nearing settlement and the lumber industry is gaining headway. Scandinavian marine engines of the Diesel type are being imported at Seattle.

New York

NEW YORK, August 2, 1916.

Quick action in placing orders for large engine lathes followed the awarding of contracts for shells by agents of Great Britain. Reports vary as to the monetary value of these contracts, but they run into many millions of dollars. In the past few days the American Locomotive Company and the E. W. Bliss Company, both of whom received contracts for making large shells, together purchased about 350 engine lathes, most of which are to be delivered within seven weeks. Lathes having a swing of from 24 in. to 30 in. are required. The American Locomotive Company has been buying in several directions, taking miscellaneous machines as well as the lathes.

The American Brake Shoe & Foundry Company is reported to have closed an order for 9.2-in. shells, valued at

approximately \$22,400,000. The total of orders so far placed is estimated at \$60,000,000. Information concerning the shell business has been coming out slowly for the reason that while it has been definitely settled as to who will receive contracts, some orders have not been formally signed. Negotiations have been sufficiently conclusive, however, to justify the purchase of materials and machinery by several companies. The Midvale Steel & Ordnance Company and the Baldwin Locomotive Works are mentioned as having practically closed contracts.

Question has arisen as to cancellation clauses in the contracts. In this connection an authority says that while most of the contracts contain a cancellation clause, it gives the contractors a time allowance, usually three months, and in addition, in case of the clause becoming operative, the purchasers agree to reimburse for all expenses incurred in connection with the contracts. The contracts closed last week specify deliveries up to March 31, 1917.

The American Locomotive Company, in addition to the \$15,000,000 contract for 8-in. shells referred to a week ago, has received another for 6-in. shells valued at \$3,000,000.

A machinery dealer in this city has received from a munitions maker an inquiry for 100 milling machines. Hand screw machines are active, many being wanted by firms having fuse contracts. The American Can Company is in the market for about 40 of these machines, and a number have been bought by Bartlett, Hayward & Co., Baltimore, Md. The General Electric Company has purchased small turret machines for delivery to West Lynn and Pittsfield, Mass.

Some attractive orders for grinding machines have been placed in the week in lots up to six. The ordinary domestic demand is mostly for one or two tools, but on the whole it is good.

Dealers continue to receive pleasing orders for export, principally to France and Italy. They sell to the exporters and receive payment on delivery to the steamship pier.

It is believed that the demand for large machines, most of which are wanted for delivery within eight weeks, will have a tendency of tightening up deliveries on smaller machines, inasmuch as manufacturers making all sizes will concentrate on the larger ones. It is expected that important orders will be placed soon for large turret lathes needed in boring operations on the heavy shells. Shell contractors are now figuring on such purchases.

The Maydrite Products Mfg. Company has purchased a three-story brick factory at Bergen, Ege and Kearney avenues, Jersey City, to which it is removing its plant from 1401 Clinton Street, Hoboken, N. J., increasing its manufacturing space from 5000 to 21,000 sq. ft. It has purchased about \$50,000 worth of new machine tools, which will largely increase its capacity for its regular line of work, which is the building of tools, jigs, dies, and gages, of which it now has all that it can handle on its present operating basis. It is not working overtime, but runs a full 8-hr. shift. About 200 machinists will be employed in the new plant. The company is now having plans drawn for an addition to the present building 50 x 87 ft., with an ell 15 x 100 ft., which will add about 36,000 sq. ft. of floor space, and will be devoted to increasing its capacity for its present lines of work. The company was established about eight months ago, with a capital stock of \$100,000. O. E. Enell is president, J. C. Janzer is vice-president, Charles Fowler is secretary and treasurer, and H. E. Eppley, formerly with the Webster Mfg. Company of Tiffin, Ohio, is general manager. The same interests have incorporated the Maydrite Machinery Mfg. Company, capitalized at \$50,000, to handle the manufacture of heavy work and products for which the rest of the shop is not equipped. It will occupy the ground floor in the plant. John E. Cabaugh, 11 Broadway, New York, is special representative of the company.

The Universal Stamping Machine Company, 416 West Thirty-third Street, New York, manufacturer of post-office machinery, etc., has acquired a plant in Port Chester, N. Y., to be used as overflow quarters for special work. It has not decided to permanently give up its New York plant, as has been stated elsewhere.

The Eastern Tool & Mfg. Company, 74 Richmond Street, Newark, N. J., will put its new plant at Bloomfield Avenue and the Erie Railroad, Bloomfield, N. J., in operation Aug. 10.

The Meldrum-Semon-Greiner Company, 107 North Franklin Street, Syracuse, N. Y., succeeds to the business of the

Crescent Machine Company, manufacturer of special machinery, tools, gages, jigs, and fixtures. It employs about 28 workmen, and specializes in tool work. Its capital stock is \$30,000. Joseph C. Semon is president, John A. Greiner vice-president, and Alexander Meldrum is secretary, treasurer and general manager.

The Corona Typewriter Company, Groton, N. Y., has awarded contract to the McClintic-Marshall Company, Pittsburgh, Pa., for the erection of a four-story reinforced-concrete building, 162 ft. long, to be added to its plant. It will be constructed with three wings 50 ft. long on one side, two four-story and one one-story, and a fourth wing, 54 x 72 ft., two stories, in the rear, giving a total added floor space of about 88,000 sq. ft., sufficient to accommodate all its present equipment and enough new machinery to double its present output. It is expected that all equipment will be complete within six or eight months. All machines will be operated in group drive by 5-hp. overhead motors. A new power plant will be added, including a 400-hp. uniflow Skinner automatic, direct-connected engine with a generator of 300 kw. and an additional 200-hp. boiler. C. T. Yates is purchasing agent.

The W. M. Sharp Mfg. Company, incorporated with a capital stock of \$50,000, has succeeded to the business and equipment of the W. M. Sharp Company, Binghamton, N. Y., manufacturer of dental specialties, and of the Binghamton Plating & Machine Works. It intends to materially increase its line of dental goods, etc. Charles T. Kinsman is president and manager, A. G. Snow is vice-president, and H. M. Smith is secretary and treasurer.

Clarence H. Booth, president of the Scripps-Booth Company, announces the incorporation under New York laws of the Scripps-Booth Corporation, with a capitalization of 70,000 shares, no par value. The company is a consolidation of the Scripps-Booth Company of Detroit, maker of automobiles, and the Sterling Motor Company, also of Detroit.

The Hydral Company, 125 Front Street, New York, has let general contracts for the construction of its oil plant at Niagara Falls, N. Y., including a factory building 50 x 100 ft., two stories, and a boiler house 30 x 34 ft., one story.

The Moore Steam Turbine Corporation, Wellsville, N. Y., has completed plans for a two-story factory, 80 x 100 ft. It has been incorporated, with a capital stock of \$160,000, by E. D. Spicer, J. B. Laird, and J. L. Moore. J. L. Moore is president.

The K. M. Davis Company, Williamson, N. Y., will erect a cold-storage building, 128 x 255 ft., two stories.

Henry N. McCracken, president of Vassar College, Poughkeepsie, N. Y., is having plans prepared for a boiler plant and improved heating system for the college buildings.

The Portland cement plant of the Thomas Millen Company, near Jamesville, N. Y., was totally destroyed by fire July 29, with all its machinery and contents. The plant was valued at \$300,000.

The warehouse, pumping station and reservoir to be added to the plant of the Eastman Kodak Company, Kodak Park, Rochester, will cost \$200,000.

The C. H. Simmons Machine Company, 985 Broadway, Albany, N. Y., has awarded contract for the erection of a one-story factory and machine shop, 125 x 131 ft., to cost about \$10,000. John Dennis, Kinderhook, N. Y., is the contractor.

The International Time Recording Company, Endicott, N. Y., has let contract to A. E. Badgley, Binghamton, N. Y., for the erection of a factory building, 50 x 200 ft.

The Acheson Graphite Company, Buffalo Street and Portage Road, Niagara Falls, N. Y., is having plans drawn for three factory buildings, one and two stories, to be erected on River Road, Tonawanda, N. Y., at a cost of about \$150,000.

The Warsaw Elevator Company, Warsaw, N. Y., plans to erect a one-story addition, 25 x 100 ft., to cost about \$15,000. C. E. Ketchum is president.

The Samuel Moore & Sons Corporation, Elizabeth, N. J., has about completed plans for the construction of a one-story powerhouse and office, 60 x 140 ft., to cost about \$25,000 and for a two-story shop, 50 x 75 ft.

The Raritan Copper Works, Perth Amboy, N. J., is having plans prepared for a two-story addition to its foundry, 33 x 43 ft., to cost about \$6,000; and for a one-story extension to its machine shop, 48 ft. square, to cost about \$6,000.

The Cott-A-Lap Company, maker of wall covering, Somerville, N. J., has drawn plans for a group of factory buildings, including a three-story office building, 40 x 105 ft., a one-story refrigerating plant, 27 x 80 ft., a manufacturing building, 60 x 500 ft., and three smaller structures. S. H. Chamberlain is superintendent.

Philadelphia

PHILADELPHIA, PA., July 31, 1916.

The Carpenter Steel Company, Reading, Pa., has purchased 68 acres of land on the bank of the Schuylkill River opposite its plant, to provide for future needs. No plans are in existence for its improvement. The Philadelphia & Reading Railway is now constructing a siding into the company's works.

The Bell Motor Car Company, York, Pa., will erect a one-story factory, 108 x 240 ft., on a 15-acre site which it has purchased adjoining the Rockburn Street station. H. M. Stauffer is president; B. F. Posey, secretary and treasurer; H. W. Posey, vice-president and general manager; H. W. Conrad, assistant general manager and general sales manager, and E. T. Gilliard, consulting engineer.

The Domestic Talking Machine Corporation, Thirty-third and Arch streets, Philadelphia, Pa., has equipped a plant and is manufacturing talking machines. It is capitalized at \$200,000. Horace Sheble is president; Marcus W. Saxman, vice-president, and Joseph E. Barnett, secretary and treasurer.

The Pyroelectric Instrument Company, manufacturer of pyrometric and electrical precision instruments, 148 East State Street, Trenton, N. J., has been incorporated with a capital stock of \$50,000. It is equipping a plant which will be completed about Sept. 15. E. F. Northrup, Princeton, N. J., is president and technical adviser; Dudley Willcox is treasurer and H. F. Porter is secretary.

The Dairymen's Supply Company, 1919 Market Street, Philadelphia, Pa., recently incorporated with a capital stock of \$30,000 to deal in dairy equipment, has established a factory at Lansdowne, Pa., where it is manufacturing a few specialties, such as bottle fillers, washers, coolers, etc. Alfred D. Steer is in charge.

The Williamsport Wire Rope Company, Williamsport, Pa., is erecting a wire-drawing plant for its own requirements and plans to have it in operation before Dec. 1. Contracts have been placed covering buildings and machinery. Garrett Cochran is president and general manager.

The Potter-Mackie Mfg. Company, Pottstown, Pa., operating a general machine shop, has started the manufacture of 45-hp. four-cylinder gasoline motors for motor trucks and will put on the market within the next three months a 30-hp. four-cylinder motor for the same use. The company is undecided whether it will remain in its present location or build a new plant. It was incorporated about a year ago with a capital stock of \$35,000 and has recently increased the capitalization to \$50,000. Norman S. Mackie is president and S. Cary Potter is vice-president and general manager. The officers, with Elton Hoyt and Amasa S. Mather, Cleveland, Ohio, were the incorporators.

The Salem Brass & Iron Mfg. Company, manufacturer of cast-iron pipe and fittings, Salem, N. J., has purchased the Hess Steel Company's plant at Bridgeton, N. J., and will use it as a branch to manufacture soil pipe and fittings and plumbers' cast-iron goods. H. G. Hart is treasurer.

The H. B. Pancost Company, 243 South Third Street, Philadelphia, manufacturer of steam fitters' supplies, is having bids taken by its architect, W. C. Furber, 418 Walnut Street, Philadelphia, for the erection of a machine shop and office building to cost about \$20,000.

The Downingtown Mfg. Company, East Downingtown, Pa., manufacturer of paper-making machinery, has started the construction of a one-story foundry to cost about \$6,000.

New England

BOSTON, MASS., July 31, 1916.

The American Power Company, Bridgeport, Conn., has been incorporated with capital stock of \$100,000 to manufacture a new type of gas engine. The incorporators are John J. Hogan of Bridgeport, John G. Hoffman of New York and John T. L. Hubbard of Hartford. The company will locate its plant in Bridgeport but the site has not been selected.

The Worcester Pressed Steel Company, Worcester, Mass., has received an order for 100,000 howitzer shell cases for the British Government. It has now on hand an order for 1,000,000 one-pounder cases for Russia and the two orders will keep the plant busy for about five months on a 24-hr. a day basis.

The New England Westinghouse plant at Meriden, Conn., has now been practically completed and it is expected to be turning out 1000 rifles a day by Sept. 1.

The Standard Metal Work Company, Thompsonville,

Conn., following the purchase of the G. H. Bushnell Press Works, an adjoining property, has reincorporated with capital stock of \$300,000. It retains the same name and the same officers and expects to greatly enlarge its output. The Standard Company manufactures engine parts for automobiles and has more business booked than it has ever turned out in a single year.

The Edward Miller Company, Meriden, Conn., has awarded a contract for an addition, 53 x 141 ft., one story, to its brass rolling mill.

The Bridgeport Piston Ring Company, Bridgeport, Conn., has been incorporated with capital stock of \$10,000 by George H. Cornell, Anna E. Moran and Charles E. Williamson.

The Precision Gauge & Tool Company, Bridgeport, Conn., has been incorporated with capital stock of \$10,000 by George H. Cornell, Anna E. Moran and Charles E. Williamson.

The Connecticut Electric Steel Company, 50 Church Street, New York, has secured a permit to erect a foundry, 125 x 158 ft., on Flatbush Avenue, Hartford, Conn. Two smaller brick buildings will also be built.

The American Aeroplane Company, Boston, Mass., has been incorporated with capital stock of \$200,000. The directors are William Stevens, Roslindale, president and treasurer; Francis W. Kittredge and Wheaton Kittredge.

The Market Forge Company, Chelsea, Mass., is having plans drawn for a new plant, 48 x 200 ft., two stories, to be erected in Everett, Mass.

Baltimore

BALTIMORE, Md., July 31, 1916.

The Monitor Controller Company, 111 South Gay Street, Baltimore, has leased three floors of the building at 514 East Lombard Street. G. H. Whittingham is chairman of the board.

The business of Charles Zies & Sons, 314-320 South Fremont Street, Baltimore, machinists and machinists' supplies, has been incorporated, with \$80,000 capital stock, by Charles, John, Charles N., William C., and Frederick Zies.

The Chesapeake Paper Board Company, Claggett and Woodall streets, Baltimore, will erect a one-story brick boiler house.

John A. Strong, 847 Calverton Road, Baltimore, will build a brick boiler house at 808 Calverton Road.

The Nash Motors Company, Baltimore, has been incorporated, with a capital stock of \$24,999,500, by Charles McH. Howard, attorney, 1409 Continental Building, Baltimore, and Robert F. Herrick, J. Wells Farley, Phillips Ketchum, and Edward A. Taft, all of Boston, Mass. It is stated the company will acquire the plant of the Thomas B. Jeffery Company, Kenosha, Wis.

Contract has been let for the construction of several new buildings for the H. B. Davis Company, paint manufacturer, at Severn and Bayard streets, Baltimore.

The Poole Engineering & Machine Company, Woodberry, Md., will build an addition to the mezzanine floor in the building at Railroad and Woodberry avenues, to cost about \$3,000.

The Baltimore Tube Company, Ostend and Wicomico Streets, Baltimore, will build an addition, 63 x 351 ft., to its plant, at a cost of about \$30,000.

Plans are being made by the Baltimore Roofing & Asbestos Mfg. Company, near Reisterstown, Md., for the construction of two additional manufacturing buildings.

The Albert C. Putts Company, Munsey Building, Baltimore, will equip the buildings at 420 and 422 West Conway Street to manufacture leather goods.

An addition will be built to the plant of the Union Envelope Company, Richmond, Va.

Announcement has been made that the Chester Paper Company, Chester, Pa., has purchased a tract of land at the foot of Market Street, adjoining its plant, and additional buildings will be erected.

Announcement is made that the Delaware Shipbuilding & Engineering Corporation has been formed, with \$1,000,000, and will establish a plant at New Castle, Del. A tract of land known as Battery Park has been acquired, consisting of about 11 acres. The front will be about 600 ft. on the Delaware River. It is understood that the company has been formed by men who are interested in shipbuilding on the Great Lakes. At the beginning, it is said, the company will construct wooden and steel vessels up to 300 ft. in length. Arrangements will also be made for constructing larger vessels.

Chicago

CHICAGO, ILL., July 31, 1916.

Those who are in position to furnish heavy lathes suitable for finishing shells as large as 12-in. are figuring actively upon several inquiries that have been coincident with the recent placing of 9.2-in. and 12-in. shells. The American Brake Shoe & Foundry Company is understood to have ordered 100 tools of a new design, and negotiations are reported with the Bethlehem Steel Company and the American Car & Foundry Company for an even larger number. Many manufacturers have put out inquiries for a variety of second-hand machinery, in the expectation of securing what they want from the dismantling of munitions shops, but the kind of tools generally desired are the ones for which munitions manufacturers can find a place in their own normal manufacturing operations, while for the special-purpose tools offered a less promising market exists. Some of these shell-turning lathes are likely to be bought in at prices which will warrant remodeling to make them general-purpose tools where their design permits.

An interesting and important speculation hinges upon the question of which phases of the war-time expansion in machine-tool manufacture will be permanent. It seems likely that when the market again becomes normal, increased competition will result more from the greater variety of tools made by long-established manufacturers than from new companies created in response to exceptional conditions.

In an interesting review of industrial activity at Chicago, the *Economist* offers the following list of current new construction:

Central Bag Company, four-story factory 95 x 194 ft., 3622-3630 Iron Street, \$125,000. National Carbon Company, four-story factory, 120 x 166 ft., 3711-3725 South Ashland Avenue, \$100,000. Cole Mfg. Company, three-story factory, 150 x 185 ft., 2436-2450 Bross Avenue, \$75,000. A. B. Dick & Co., seven-story factory, 50 x 104 ft. and 43 x 74 ft., 740-742 West Jackson Boulevard, \$60,000. Sigmund Greenblatt, three-story addition, 100 x 126 ft., southwest corner Adams and Halsted streets, \$50,000. Sherwin-Williams Company, one-story factory, 124 x 266 ft., northwest corner Stevenson Avenue and 116th Street, \$40,000. Justrite Mfg. Company, four-story factory, 32 x 74 ft., 1452-1454 Fargo Avenue, \$40,000. Commercial Furniture Company, three-story factory, 75 x 175 ft., 2711-2729 West Chicago Avenue, \$38,000. Barrett Mfg. Company, additional story and one-story alterations to factory, 142 x 181 ft., northwest corner Twenty-ninth Street and Sacramento Avenue, \$35,000. Victor Mfg. & Casket Company, three-story factory, 50 x 125 ft. and 45 x 46 ft., 1944-1946 South Troy Street, \$33,000. National Brewing Company, two-story factory and office, 75 x 125 ft., 1916-1920 West Eighteenth Street, \$30,000. George S. Carrington, two-story factory, 59 x 115 ft., 2338-2340 West Van Buren Street, \$25,000. H. H. Walker, one-story factory, 146 x 150 ft., southeast corner Taylor and Waller streets, \$24,000. Zeitler & Lamson, two-story factory, 75 x 175 ft., 4644-4650 West Madison Street, \$22,000. S. Loeb, two-story factory, 50 x 164 ft., 3426-3428 South Wabash Avenue, \$22,000. H. E. Holsinger, factory, 44 x 71 ft., 212-214 Sheldon Street, \$20,000. Independent Can Company, two-story factory, 49 x 100 ft., 1748-1758 West Kinzie Street, \$20,000. N. Johnson Mfg. Company, two-story addition, 56 x 95 ft., 1235-1237 North California Avenue, \$20,000. I. Horween, two-story factory, 87 x 95 ft., 1051 West Division Street, \$20,000. Harry R. Gibbons, one-story factory, 75 x 125 ft., 1210-1214 West Lake Street, \$20,000. L. R. Harsha, four-story factory, 60 x 75 ft., 405-411 North Lincoln Street, \$20,000. Sasgen Derrick Company, two-story factory, office and auto shed, 57 x 204 ft., and 25 x 42 ft., 3101-3109 Grand Avenue, \$18,000. A. Rohn, two-story factory, 60 x 113 ft., 2016-2018 West Lake Street, \$18,000. Frank Vogler, two-story warehouse, 40 x 75 ft., 35 x 99 ft. and 30 x 35 ft., 1684-1688 Elston Avenue, \$17,000. Robert Malcolm, two-story factory, 59 x 125 ft., 2300-2302 Warren Avenue, \$16,000. John F. Mortenson, three-story factory, 60 x 63 ft., 345-347 North Oakley Avenue, \$15,000. F. W. Williams, three-story factory, 51 x 126 ft., 2531-2535 West Taylor Street, \$15,000.

W. A. Jones Foundry Company, two-story foundry, machine shop and office, 1200-1258 South Kostner Avenue, \$200,000. Link Belt Company, one-story steel shop and boiler house, 3596 West Thirty-ninth Street, \$50,000. Great Western Smelting & Refining Company, one-story foundry, 47 x 410 ft., 626-628 West Forty-first Street, \$50,000. Acme Steel Goods Company, three-story warehouse, 92 x 105 ft., 2708-2714 Farrell Street, \$40,000. Western Steel Car & Foundry Company, one-story steel forge shop, 71 x 602 ft., 136th Street and Brandon Avenue, \$37,500. Lasker Iron Works, one-story boiler shop, 100 x 300 ft., 3201-3229 South Lincoln Street, \$25,000. Illinois Steel Company, one-story skull crusher structure, 75 x 200 ft., between Eighty-second and Eighty-third Streets, east of Brandon Avenue, \$22,000; also addi-

tion to factory between Eighty-ninth and Ninetieth streets, east of Strand Avenue, \$19,000. Gage Structural Steel Company, two-story shop and office building, 25 x 40 ft. and 66 x 200 ft., 3125-3141 South Hoyne Avenue, \$20,000. Cyclone Blow Pipe Company, two-story factory, 75 x 120 ft., 2542-2552 West Thirty-first Street, \$20,000. D. O. James Mfg. Company, three-story addition to machine shop, 1124 West Monroe Street, \$15,500. Ryan Car Company, one-story power house, 37 x 200 ft., remodeling, 135th Street and Brandon Avenue, \$15,000.

Stewart-Warner Corporation, six-story factory, 191 x 286 ft., 2829-2843 North Lincoln Avenue, \$250,000. N. Landon Hoyt, four-story garage, 100 x 199 ft., 57-65 East Twenty-first Street, \$118,000. Louis Geyler & Co., three-story salesroom, 80 x 180, 2453-2459 Indiana Avenue, \$100,000. Ford Motor Company, two-story factory addition, 128 x 365 ft., northeast corner Wabash Avenue and Fortieth Street, \$100,000; four-story auto station, 75 x 122 ft., 4301-4307 West Madison Street, \$60,000; four-story blacksmith shop, foundry and machine shop, 75 x 125 ft., 4317 Broadway, \$60,000. Ogren Motor Company, three and one-story factory and garage, 2947-2967 Grand Avenue, \$60,000. Christoffer Motor Company, one-story salesroom and repair shop, 123 x 125 ft., 3312-3322 Sheffield Avenue, \$20,000. Drover Garage Company, garage, 116 x 160 ft.

The Mitchell Auto Service Station, 2540 Michigan Avenue, Chicago, will erect a three-story building, 50 x 120 ft., at a cost of \$50,000. S. Scott Joy, 1118 West Thirty-fifth Street, is the architect.

W. Sebastian, 3421 North Halsted Street, Chicago, will build a one-story garage to cost \$12,000, and Mark Henry, 422 Federal Street, a two-story garage to cost \$14,000.

The Holt Mfg. Company, East Peoria, Ill., tractor manufacturer, will build a one-story, steel frame foundry, 116 x 250 ft., and is completing a one-story machine shop 206 x 216 ft.

The Hanna Engineering Works of the Vulcan Engineering Sales Company, at 2059 Elston Avenue, Chicago, Ill., has been sold and the company is now seeking a new site from 2 to 5 acres, preferably with an existing manufacturing building, 100 x 300 ft., or over, with shipping facilities and good labor supply available, etc. A. F. Jensen is manager.

The McCauley Belting Company, Chicago, has moved its factory to 412-420 Orleans Street, to take care of the growth in its business. Additional machinery has been installed.

The Anderson, Shumaker Company, general blacksmith and steam forger, has moved to 824 South Central Avenue, Chicago.

The Illinois Watch Company, Springfield, Ill., has awarded a contract for the enlargement of its plant, to cost approximately \$15,000.

The Moline Plow Company, Rock Island, Ill., has let the contract to the Stone & Webster Company, 38 South Dearborn Street, Chicago, for its new plant, to cost about \$500,000.

The Williams Motor Company of Chicago has leased a factory at Waukegan, Ill., which will be equipped with modern machinery to manufacture its motors and bridge control systems. It expects to either purchase or build a plant in Waukegan as soon as a suitable location can be obtained.

The Ireland & Matthews Mfg. Company, Detroit, Mich., is about to erect a four-story factory on the Michigan Central Railway between Beard and Green avenues. The main building will be 60 x 700 ft. Contracts for the work have been let by John Scott & Co., the architects.

The Western Iron & Foundry Company, Wichita, Kan., has built an addition to its shops, to be used exclusively for ornamental iron work, and for the manufacture of a special new automatic coal chute.

F. E. Potter & Sons, Sioux City, Iowa, have completed their new plant, 50 x 50 ft., and are installing suitable equipment for building fire escapes.

The Monroe Body Company, Pontiac, Mich., will erect a new office building and pressed steel plant, to take care of its growing business. The capital stock has been increased to \$150,000.

Indianapolis

INDIANAPOLIS, IND., July 31, 1916.

The Indianapolis Corrugating Company has increased its capital stock from \$100,000 to \$150,000.

The Indiana Tank & Boiler Works, Indianapolis, has been incorporated, with \$10,000 capital stock, to manufacture steel plate and sheet-iron products. The directors are J. E. R. R., and H. E. Bossingham.

The Universal Motor Products Company, Indianapolis, has been incorporated with \$100,000 capital stock, to manu-

facture auto parts. The directors are Allen P. Vestal, R. Davidson, and Smiley N. Chambers.

T. H. Baltzell, County auditor, Decatur, Ind., is asking for bids until Aug. 7, for a sectional boiler for the County jail heating plant; F. A. Hausheer, County auditor, Laporte, Ind., until Aug. 11, for the construction of two 16 x 72 horizontal tubular boilers, 125 hp., or two water tube boilers of equivalent capacity. Thomas Ferguson, County auditor, Terre Haute, Ind., asks for bids until Aug. 12 for return steam boiler for County poor asylum.

The Nappanee Carriage Works, Nappanee, Ind., has been incorporated with \$40,000 capital stock, to manufacture vehicles. The directors are David F. Miller, Roy R. Berlin, and Ira C. Strohm.

The Star Generator Company, Logansport, Ind., has been incorporated with \$50,000 capital stock, to manufacture generators. The directors are Edgar F. Metzger, Harry C. Metzger, and Orpha Carter.

The Main Welding & Battery Service Company, formerly the Autogenous Welding Company, South Bend, Ind., has moved to 223 South Main Street, where a complete plant for welding of all kinds is being installed.

It is announced that George W. Dunnyham, Evansville, Ind., formerly with the Chalmers Motor Company, is organizing a company with \$2,000,000 capital stock, to manufacture automobiles at that place.

The Root-Johnson Ventilating Company, Indianapolis, has been incorporated with \$10,000 capital stock, to manufacture ventilators. The directors are William R. Root, Ralph C. Root, and M. G. Root.

Milwaukee

MILWAUKEE, WIS., July 31, 1916.

The production of machine tools in the Milwaukee district for July compares favorably with that of preceding months, and builders enter the new month with a very satisfactory volume of business on their books. The demand for milling machines is being well maintained, the automobile industry furnishing the largest buyers. Some inquiry is noted for foreign account, but the large bulk of business is from domestic sources. Buying is almost wholly confined to requirements for replacements and equipment of plant extensions, which generally means standard types and single tools or small lots. Dealers in used tools report stocks moving satisfactorily and in fair volume. In this district the number of second-hand tools offered for sale is less than expected.

The Mitchell Motors Company of New York has increased its capital stock from \$5,000 to \$625,000, and takes over the Mitchell-Lewis Motor Company, Racine, Wis., both business and property. It has also acquired the plant and equipment of the Mitchell Wagon Works, at Racine, but not its wagon business. The plant will be used for the manufacture of automobile bodies. Permanent officers and directors of the company have not been elected as yet. H. L. McClaren is president.

C. A. Pope, Darlington, Wis., has sold his machine shop to J. W. Wilkinson, who will install equipment and conduct a machine shop.

The Chicago & Northwestern Railway has been granted permits at Milwaukee to construct a repair shop costing \$2,500. The building will be erected by the Charles W. Gindele Company, 3333 South LaSalle Street, Chicago.

The Werra Aluminum Company, Waukesha, Wis., maker of aluminum castings, has engaged the Thomas S. Watson Company, consulting engineers, Majestic Building, Milwaukee, to prepare plans for an addition to its foundry, occupying the former Wisconsin Central Railroad shops. The Werra Company does a large business with automobile motor manufacturers, and has been crowded for room for many months.

J. C. Haberman, Prairie du Sac, Wis., is installing machine-tool equipment in his machine shop, including boring and reaming machines and lathes. G. E. Lampmann is superintendent.

The Invincible Metal Furniture Company, Manitowish, Wis., is reorganizing its official and production organizations, following the retirement of A. L. Noel, president and general manager. Negotiations are under way for the sale of the entire output for a term of years on contract.

The Four Wheel Tractor Company, Clintonville, Wis., has perfected its organization, and will start production at once. The company originally was organized by interests at Antigo, Wis., and a short time ago was taken over by Clintonville capital identified with the Four Wheel Drive Auto Company. The officers just elected are: President, Dr. Charles Topp; vice-president, W. H. Finney; secretary, A. B. Mayhew; treasurer, L. C. Larson. The directors include the officers and Alex Stewart, Henry Zarling, and F. M. Hyde.

The Lyons Boiler Works, DePere, Wis., now in the hands of a receiver, is being overhauled and put into shape for operation. The plant has been idle for more than a year. The receivership is being closed up, it is stated, and the shops doubtless will go into the hands of A. P. Denkmann, Rock Island, Ill.

Pattison Brothers, Mondovi, Wis., will erect a garage and machine shop costing about \$4,500.

The General Welding & Mfg. Company, Milwaukee, has awarded all contracts, and work is now under way on its new plant on Oregon near Greenbush Street.

The Overland-Wausau Company, Wausau, Wis., has broken ground for a garage and service station 66 x 120 ft., three stories and basement, to cost \$30,000.

The Hoppe-Hatter Motor Company, 543 Broadway, Milwaukee, is building a new garage and repair shop 60 x 120 ft., two stories and basement. Adolph C. Hoppe is president.

R. J. McGeehan, Son & Co., DePere, Wis., makers of machinery and farm implements, which recently passed to the control of Grover McGeehan, have purchased adjoining buildings, and will remodel them into a garage and machine shop.

The Yawkey-Bissell Lumber Company, Wausau, Wis., has been organized with a capital stock of \$350,000. It will construct a mill in Langlade County, Wis., at once, of the double-band type, with resaw, and including a planing mill. The annual cutting capacity will be 25,000,000 ft. The drive will be by a steam power plant. C. C. Yawkey, W. H. Bissell, Walter Alexander, and W. W. Gamble, are the chief owners.

The Townsend Mfg. Company, Janesville, Wis., is now on a regular production schedule of kerosene-burning tractors of 20 hp., and deliveries are being made to jobbers.

The Boone Tire & Rubber Company, Des Moines, Iowa, is negotiating with the Business Men's Association, Beloit, Wis., for a site upon which it plans to build a \$25,000 branch factory. It has an authorized capital stock of \$500,000, and operates a rubber works at Des Moines. I. V. MacLean is general manager.

The Reitman-Straus Company, Majestic Building, Milwaukee, will build a garage and machine shop, 50 x 150 ft., on Fifth Street. The work is in charge of Matt & Klenzen-dorff, architects.

The Chippewa Falls Foundry & Machine Company, Chippewa Falls, Wis., has increased its capital stock from \$25,000 to \$100,000. Plans are being made for the erection of a new plant, but details have not yet been announced.

Cleveland

CLEVELAND, OHIO, July 31, 1916.

Considerable inquiry is out for small lots of machines, mostly lathes, wanted for early delivery. By shopping around buyers are able to find some machines they desire. Several new round lot inquiries are pending, including one from a Youngstown manufacturer for 35 machines for work on high explosive shells. The placing of this order is dependent upon the company securing the shell contract which is pending. The extreme hot weather is interfering with operations in many plants as many men refuse to work more than part of the time. This has affected automobile plants in the Central West. Although some of these plants have cut down on their production, as is usual at this time of the year, complaint is made that because of lack of sufficient workmen it is impossible to operate at the desired schedule. The automobile forge shops are particularly affected.

Dodge Brothers, Detroit, will remodel their present foundry into a continuous foundry and will install new handling and other equipment, including core ovens. Plans for the changes have been prepared by Smith, Hinchman & Grylls, engineers, Detroit, who will shortly place contracts for the required equipment.

The Ford Motor Company, Cleveland, will erect a four-story concrete and steel service station, 100 x 145 ft., at Detroit Avenue and West Sixty-fifth Street.

The Electric Controller & Mfg. Company, Cleveland, will enlarge its plant by the erection of a five-story steel and concrete building. The first three floors will be used for manufacturing and the upper two for offices.

The Columbian Hardware Company, Cleveland, has taken out a permit for a two-story factory addition, 27 x 83 ft.

The S. P. Mfg. Company, Cleveland, has been incorporated with a capital stock of \$25,000 to manufacture tools and patterns. Carl S. Shuler, L. Hopkins, and others are the incorporators.

The Seiss Mfg. Company, Toledo, Ohio, has purchased the

plant of the Toledo Plow Company which will be fitted up with new equipment to manufacture automobile horns.

The Timken Roller Bearing Company, Canton, Ohio, has taken out permits for a two-story office building 105 x 206 ft.; a grinding department, one-story, 100 x 105 ft.; a one-story hardening room, 50 x 100 ft., and a packing room, 43 x 80 ft.

The Stevens Metal Products Company, Niles, Ohio, has been incorporated with a capital stock of \$50,000 to manufacture steel drums and other sheet metal products. The incorporators include W. H. Stevens, Edward Thompson, Harry M. Scriven, C. E. McConnell, and H. A. Bergess.

The Tillotson Mfg. Company, Toledo, Ohio, manufacturer of carburetors, will erect a four-story factory building providing 100,000 sq. ft. of floor space.

The Ohio Locomotive Crane Company, Bucyrus, Ohio, has elected Charles F. Michael president, C. T. Rogers vice-president, A. G. Stoltz secretary, and W. H. Picking treasurer. Mr. Michael was formerly secretary of the company.

It is reported that the General Tire & Rubber Company, Akron, Ohio, will build another addition to its plant. It has made application for an increase in capital stock from \$200,000 to \$500,000.

The National Grave Vault Company, Gallon, Ohio, will enlarge its plant by the erection of a two-story brick building, 50 x 150 ft., and a wing, 50 x 90 ft.

Cincinnati

CINCINNATI, OHIO, July 31, 1916.

Makers of sheet metal machinery are all busy. The local machine tool plants also have considerable work ahead, but the extremely hot weather has tended to cut down production. Some complaint is registered with the foundries who are not able to make deliveries on time in some cases. Reports as to the receipt of additional orders for high-explosive shells by southern Ohio manufacturers appear to have some foundation, but munition makers have not lately bought any extensive lists of machine tools in this market. The Canadian demand is also a little slower.

Mill and factory supply dealers state that deliveries on machinists' supplies are becoming easier, although manufacturers are still curtailing the amount of purchases on many articles. Small electric motors are in especially good demand, but the call for larger units of generators and motors is only nominally good. The boiler and tank makers are busy.

It is reported that an addition to the plant of the Mumaw-Harbor Company, 711 Carr Street, Cincinnati, manufacturer of automobile fenders and other specialties, will be made at an early date. It is understood that Victor Murray has recently acquired an interest in the firm.

Work has been commenced on the foundations for an addition to the plant of the Cincinnati Planer Company, in Oakley suburb, recently mentioned as contemplated.

The Cincinnati Wire-Bound Box Company, Cincinnati, has increased its capital stock from \$200,000 to \$400,000 and will probably make some additions to its plant at an early date.

The A. J. Vail Tractor Company, Hamilton, Ohio, has leased part of a manufacturing building to be used for the manufacture of gasoline farm tractors. Most of the equipment has been purchased.

The New Foundry Appliance Company, Hamilton, Ohio, has been incorporated with \$25,000 by Frank J. Becker, George F. Dana and others to manufacture a special molding device. A factory will probably be built at a later date, but for the present the devices will be made in the plant of the Hamilton Caster & Mfg. Company.

The Kelly-Springfield Motor Truck Company, Springfield, Ohio, has made an additional shipment of 32 large trucks to the War Department for use on the Mexican border.

The Metallic Casket Company, Springfield, Ohio, is fitting up a new plant on West North Street to be used to manufacture metallic caskets.

The main building of the Blackwood Steel Foundry Company's plant at Springfield, Ohio, is now under roof and the work of installing the necessary equipment will be commenced at an early date.

The C. A. S. Products Company, Columbus, Ohio, maker of automobile gears, is reported to be contemplating further extensions to its plant.

The Shelby Spring Hinge Company, Shelby, Ohio, has increased its capital stock from \$325,000 to \$450,000. Nothing is known regarding additions to its plant.

The West Newark Range & Furnace Company, Newark, Ohio, has been organized by C. W. Cunningham and others to erect a foundry for the manufacture of stoves, ranges and heaters.

St. Louis

St. Louis, Mo., July 31, 1916.

A satisfactory machine-tool trade is being done, although no large lists appear. The demand for single tools keeps up. No report of interference with business by resale equipment from munition plants has been noted. Crop reports have not begun to materially affect business conditions.

The Foerster & Kaysing Iron Works, St. Louis, Mo., have been incorporated, with a capital stock of \$10,000, by Henry E. J. Foerster, John E. Foerster, William G. Kaysing, and others, to fabricate iron and steel structural materials.

The Reliance Oil & Gas Burner Company, St. Louis, Mo., has been incorporated, with a capital stock of \$300,000, by Julius F. Hauke and others, to manufacture gas and oil burners.

The Sweet Power Transmission Company, St. Louis, Mo., has been incorporated, with a capital stock of \$15,000, by Allen H. Sweet, Francis C. Gerbig, and others.

The Champion Auto Spring Company, St. Louis, Mo., has been incorporated, with a capital stock of \$15,000, by Thomas J. Ryan, J. W. H. Sasse, and Walter B. Donnell, to manufacture automobile springs.

The Carondelet Packing Company, St. Louis, Mo., has increased its capital stock from \$60,000 to \$100,000, for the purpose of adding to its packing-house equipment.

The Reflectolyte Company, St. Louis, Mo., has been incorporated, with a capital stock of \$50,000, by Frank Adam, H. C. Adam, and C. J. Bente, to manufacture lighting fixtures.

The St. Louis Felling Machine Company, St. Louis, Mo., will erect and equip a factory for the manufacture of its machines. Charles L. Knower is president.

The Kansas City Brick Company, Kansas City, Mo., incorporated in Kansas, has been given permission to use its \$40,000 capital in Missouri in equipping and operating a plant.

The Grassensbacher Mfg. Company, Overland, Mo., has been incorporated, with a capital stock of \$15,000, by H. E. Grassensbacher, A. W. Jaeger, and others, to manufacture metal specialties.

The Rotor Motor Car Corporation, Hannibal, Mo., has increased its capital stock from \$350,000 to \$400,000, and will add to its plant equipment.

The Niangua-Osage Junction Mining Company, Lebanon, Mo., is in the market for electric hoists, motor-driven air compressors, air drills, crushers, rolls, pumps, mills, etc., for mining-plant equipment. Guy R. Stanton is manager.

The Arkansas Brick & Tile Company, Little Rock, Ark., has been incorporated, with a capital stock of \$300,000, by W. A. Hicks, John Cochran, and M. H. Long, consolidating the Arkansas Brick & Mfg. Company and the Clark Pressed Brick Company. Additions will be made to the brick and tile machinery.

The Stuttgart Public Service Company, Stuttgart, Ark., will equip electric light, power, heat, and waterworks plants to cost about \$150,000.

C. C. Epps and others will equip a cotton-oil cake mill at Bristow, Okla., the machinery to cost about \$25,000.

The Phoenix Refining Company, Sand Springs, Okla., will double its present plant equipment, which has an output of 2500 bbl. daily.

The Monarch Gasoline Company, Tulsa, Okla., has been incorporated, with a capital stock of \$300,000, by John P. Pollard, F. B. Dillard, and others.

The Erwin Gin & Mill Company, Erwin, Miss., has been incorporated, with a capital stock of \$16,000, by J. H. Preston, J. H. Crouch, and others, and will equip a cotton gin and cotton-seed oil mill.

The Amory Lumber Company, Amory, Mass., will equip a planing mill with a daily capacity of 40,000 ft. of lumber. L. F. Garrett, C. L. Ray, and others, are stockholders.

J. D. Kennedy will equip a plant for the manufacture of guncotton and other explosives near Columbus, Miss.

George R. Wright, care of the Louisiana Fiber Board Company, Bogalusa, La., will begin, with associates, the construction of a plant for the manufacture of box fiber for fancy paper cartons, involving an investment of about \$900,000. Friend & Webber, New Orleans, La., are the engineers. G. H. Wood, Monroe, Mich., is interested also.

The Sewerage and Water Board, New Orleans, La., F. S. Shields, secretary, City Hall Annex, is in the market for two traveling cranes of 15 tons capacity each. Bids close Sept. 13.

The McNary Saw Mill Company, McNary, La., will rebuild its plant, recently burned with a loss of about \$200,000.

The Central South

LOUISVILLE, KY., July 31, 1916.

Extraordinarily good business continues, mostly domestic. Metal-working plants are operating at capacity in practically all departments. One manufacturer states that business on the books or in sight insures continuation on the same scale for a year. Oil well and quarrying equipment are in good demand. Air compressors and contractors' equipment are also active. A shortage of labor is occasioning some trouble.

The Southern Star Graphite Company, Louisville, incorporated with \$50,000 capitalization, proposes to establish a 400-ton mill at Ashland, Ala., for the recovery of graphite and is asking prices on crusher, conveyors, dryers, motors, etc. The incorporators are George G. Montz, 1627 Story Avenue; W. S. Montz, Charles W. Stoecker, E. D. Noe, M. L. and Frank Collyer.

The Louisville Lead & Color Company, Louisville, contemplates the purchase of twelve or fifteen 25 hp. motors.

The Reliable Paint Company, Louisville, has leased a building at 906-908 East Main Street which it will equip as a paint manufacturing plant, to use the electric drive. Motors will be provided for when installation questions are settled. William E. Mullin is president and general manager.

B. C. Berry, Danville, Ky., has awarded a contract for the construction of a fireproof garage, 80x136 ft., for Durham & Mahan.

The plant, stock, etc., of the Rodgers Electrical Company, Owensboro, Ky., have been purchased by H. B. Lucas, who will continue the business.

Plans have been completed by the Anglo-American Milling Company, Owensboro, Ky., manufacturer of flour mills, for an additional 15,000 sq. ft. to the floor space and equipment to manufacture a patented wheat separator and scourer.

The Auburn Mills, Auburn, Ky., will be remodeled and wheat cleaning machinery and other equipment will be installed.

A factory to manufacture hogsheds is to be built by George W. Tomlinson, Winchester, Ky., and 20 motors of 3 to 30 hp., and a 100 kw., 60-cycle, 220-volt, belted, alternating current generator of 600 r.p.m., will be purchased.

Fire destroyed the machine shop of the Jellico Foundry & Machine Company, Jellico, Tenn., at an estimated loss to the machinery of \$12,000.

A second-hand, 18-in., belt-driven drill press, adjustable head, combined belt and lever feed, is wanted by Robert R. Nixon, selling agent, 319 Hamilton National Bank Building, Chattanooga, Tenn.

The Kelsey Wheel Company, Memphis, A. E. Mahannah, general manager, will add to its plant and equip to manufacture automobile wheels complete with hubs and steel tires. Addition to the power plant will also be made.

Birmingham

BIRMINGHAM, ALA., July 31, 1916.

Machinery business is duller now than it has been since the revival following the early days of the European War. No explanation is given, beyond the fact that development of many sorts in the South has stopped for various causes. The great damage wrought by floods has put a damper on country trade for the time being. Undoubtedly the cessation of structural work, caused by high prices of finished products, especially steel, is another prime factor in promoting depressing conditions.

The Axton-Noe Graphite Company, Pyriton, Ala., capital stock \$40,000, has been incorporated by W. F. Axton, A. E. Noe, I. P. Axton, and others, and will build a 100-ton graphite plant.

The Henderson Fiber Asphalt Company, Girard, Ala., capital stock \$200,000, has been incorporated by E. E. Dysard, C. C. Peters, J. W. Crawford, and others.

The Reliance Equipment Company, 112 North Water Street, Mobile, Ala., desires to receive catalogs of machinery, mills supplies and heavy iron and steel products to replace files which were destroyed recently by flood in the business district of Mobile.

The McNary Lumber Company, McNary, Miss., will rebuild its sawmill, lately burned, at a loss of \$250,000.

The Savannah Engineering and Construction Company, Savannah, Ga., will build ships, equipping a plant with sawmills, air compressors, woodworking machinery, etc. Wayne Cunningham is president.

C. G. Wilkinson, of the Wilkinson Machine Company, Savannah, Ga., and others, contemplate establishing a ship-

building plant on Hutchinson's Island for building barges and small schooners. A company with \$100,000 capital is planned to be organized.

Texas

AUSTIN, TEX., July 29, 1916.

The North Texas & Santa Fe Railroad has been incorporated, with a capital stock of \$100,000, for the purpose of constructing a railroad from Hansford, Tex., to Fargo, or some other point in Ellis County, Okla., a distance of about 100 miles. The principal offices are at Hansford. It is an Atchison, Topeka & Santa Fe project. E. P. Ripley, Chicago, Ill., is one of the incorporators.

The Lubbock & Great Northern Railroad Company has been organized for the purpose of constructing a railroad from Lubbock to Wellington, Tex., a distance of 150 miles. The principal offices are at Lubbock, and the capital stock is \$150,000. The incorporators include J. M. Elliott, S. S. Houston, and F. V. Leak.

The Texas Refineries Company, San Antonio, will make improvements to its plant at a cost of about \$250,000, including eight cotton-seed oil presses, refining equipment, a conveyor system, three new boilers, and a 750-hp. engine.

The Robinson Sash & Door Company, which recently increased its capital stock from \$5,000 to \$10,000, will enlarge its plant at Houston.

The Pool Mfg. Company, Britton, Okla., plans to build a plant at San Antonio for manufacturing cotton choppers, planters, and tillers. S. M. Pool is president.

The Martin Wright Electric Company, San Antonio, has been incorporated, with a capital stock of \$30,000, by Martin Wright and others.

The Douglas Traction & Ice Company, Douglas, Ariz., will build an ice and cold-storage plant at a cost of \$100,000. The ice plant will be of 100 tons daily capacity.

The Agricultural Products Corporation, subsidiary of the International Rubber Company, 225 Fifth Avenue, New York, will build a factory at Tucson, Ariz., for extracting crude rubber from the wild guayule shrub. The company plans to also devote about ten thousand acres of land in that vicinity to growing the shrubs. Gen. L. H. Manning, Tucson, is a stockholder.

The Dalhart Water Company, Dalhart, will construct a waterworks plant and system at a cost of about \$50,000. Sam A. Killen is in charge.

The Owen-Burnet Gin Company, Lodge, will build a cotton gin to cost about \$12,000. W. J. Owen is a stockholder.

The Pacific Coast

SEATTLE, July 25, 1916.

Good progress has been made toward the settlement of labor troubles in the Pacific Northwest, and the lumber industry is gradually regaining headway, the tendency to keep production within reasonable limits being a reason for much encouragement. Orders are now ahead of production, and the outlook is good. Demand for lumber machinery is only fair, being mostly in the way of replacements and extra parts, though the many wooden shipbuilding plants now springing up are buying bandsaws, planers and air compressors, with motors or small engines. Marine engines and hoisting machinery are in good demand, for export as well as local trade, while some Scandinavian Diesel marine engines are being imported. Metal-working equipment is in good demand, and local stocks are kept closely cleaned up, though purchases are mostly of single tools of standard design. There is a scattering inquiry for special tools from the larger plants, however, and such buyers show little hesitation in placing their orders for such delivery as is obtainable.

The Gyrotron Corporation, Reno, Nev., has been organized with a capitalization of \$400,000 by Raymond T. Ashley, George A. Campbell and H. A. Lemmon. It proposes to build a factory for the manufacture of pumps, motors, engines, etc.

The American Shipbuilding Company, Astoria, Ore., has been incorporated with a capital of \$150,000, and has let a contract for the construction of ship ways near that city. H. B. Spear is president.

The Elliott Bay Ship & Engine Company, Seattle, will start work early next month on a new shipyard on the East Waterway of Seattle harbor at an estimated cost of \$250,000. C. O. Morrow is president.

The American Can Company, New York, has filed plans for its proposed plant in Seattle, Wash., which will provide for a main building, 120 x 240 ft., five stories, to cost \$200,000. The work will be rushed to completion. A frame dock warehouse, 60 x 300 ft., to cost \$40,000, will also be built.

The Bridgeford Mining & Machinery Company, Spokane, has been incorporated for \$50,000 by Carl M. Bridgeford, Charles S. Bridgeford and G. D. Menefee.

The Wallace Shipyard, Vancouver, B. C., has recently received orders for three twin-screw wooden motorships to be constructed for H. W. Brown & Co., Vancouver, a newly formed shipping firm. The vessels will be 225 ft. long, will have capacity of 1,500,000 ft. of lumber, and will cost about \$170,000 each. Brown & Co. also have two similar vessels under construction in Victoria shipyards.

Eli Brumberg, Hoquiam, Wash., has taken over the plant of the Universal Mfg. Company, Aberdeen, which he will rebuild and convert into a factory to manufacture a patented blocking.

The Armstrong Machinery Company, Spokane, Wash., has recently secured contracts for supplying ice-making and refrigerating machinery for an ice factory to be built by the Kishore Ice Company at Cawnpore, India. Stanley Myall is president.

The sawmill of F. K. Baker, Everett, Wash., will be enlarged and improved at a cost of \$20,000. New equipment will include a 10-ft. bandmill, an automatic trimmer, a band resaw and two new boilers. The mill will be extended 100 ft.

The Rhodes Harvester Company, Moscow, Idaho, will immediately move its plant to Colfax, Wash., where an enlarged plant will be constructed. The capital stock has been increased by \$15,000. J. J. Miller, Colfax, has been elected president, and Charles L. Mackenzie, vice-president. The initial building will be 60 x 300 ft.

O. M. Graves, Dwight T. Heter and James W. Meyers, all of Ephrata, Wash., will construct a factory for the manufacture of an ice-less cooler.

A. R. Barnett, Seattle, contemplates the construction of a factory in Pullman, Wash., for the manufacture of a patented knife. The proposed plant will produce 1000 knives daily.

Announcement is made by Galbraith, Bacon & Co., building material dealers, Seattle, that plans are now being prepared for a cement plant to cost about \$1,000,000, which is to be erected at Darrington, Wash., where the company owns a 600-acre site. Contract for the 2200-bbl. plant has been awarded to the Black Construction Company, Seattle. Work will start immediately, and the plant will be in operation by July, 1917. Plans provide for twelve buildings.

The Mays Mining & Milling Company, Seattle, plans the immediate construction of a factory and workshop in Georgetown, Wash., for the manufacture of a device to reduce the cost of grinding quartz. Contracts for a number of its quartz mills have been closed.

Contract has been let for the tearing down of the Greeninger wagon factory building at San Jose, Cal., and the erection of a brick automobile machine shop on the site. The new building is to be used by the San Jose Implement Company.

Canada

TORONTO, July 29, 1916.

Though the Canadian manufacturers have all the shell orders they can take care of, production continues away below the expected total, according to the returns to the Imperial Munitions Board. The exact shortage is not stated, and varies considerably, but in many cases the monthly or weekly output is below half of what it should be. The difficulty is in lack of sufficient co-operation, parts of the industry being held back because of the delinquency of others. In their anxiety to get orders many manufacturers have apparently trusted to luck as to their ability to fill them.

British orders in Canada for shells and high explosives now total nearly \$500,000,000. So far Canada has delivered over \$200,000,000 worth and at present the value of daily deliveries is nearly \$1,000,000. By the end of the year this will be increased to \$35,000,000 per month. The new fuse plant at Montreal is now being operated with great success, and this country can now produce for Great Britain over 20,000 completed shells daily. The chief difficulty now is the scarcity of skilled workmen. The employment of more female labor is being urged by the Imperial Munitions Board, which is distributing an illustrated booklet regarding the training and employment of women in munition production.

The Imperial Munitions Board at Ottawa, Ont., is allotting a further series of shell orders from Great Britain. Owing to the secrecy which the censor thinks advisable, details of the contracts or their distribution are not being made public.

The E. Long Company, Orillia, Ont., has taken over the Tudhope-Anderson Company's wheel works building and will equip it for a machine shop.

The plant of Brown-Boggs Company, King William Street, Hamilton, Ont., manufacturer of tools, metals, etc., was destroyed by fire with a loss to building and machinery of \$75,000.

W. J. Trimble, care of the Ontario Paper Company, Thorold, Ont., has been awarded the contract for the erection of a sulphite mill for the Ontario Paper Company and also a contract for the construction of an addition to the machine room of the Ontario Paper Company, Thorold, Ont. These two contracts will amount to approximately \$1,000,000.

Witchall & Son, 156 St. Helens Avenue, Toronto, has received the contract for the erection of an ice plant for the William Davies Company, Front Street East, to cost \$50,000.

The plant of the Doon Fibre Company, Doon, Ont., was destroyed by fire with a loss of \$40,000.

The Dominion Steel Products Company, which will manufacture 9-in. shells, has decided to establish a plant at Brantford, Ont. It will put up a main building, 90 x 400 ft., and employ at the outset 450 workmen. After the war the company will go into another line already decided on.

J. Sutherland, 216 Cooper Street, Ottawa, Ont., has received contract for the erection of a power plant on Slater Street for the Imperial Realty Company, Ottawa, to cost \$30,000.

F. F. Wilson, superintendent of the Indian Lake Lumber Company, Osagan, Ont., announces that he is preparing to develop a water-power on the river and is in the market for water wheels, machinery, etc.

The Northern Company Power Company, Porcupine, Ont., will install a 4000-hp. water turbine and generator in its power plant at Wawaitin, Ont.

Crotty & Elliott, Bothwell, Ont., are having plans prepared for an oil power plant to be erected at a cost of \$5,000.

St. John, N. B., will provide \$30,000 for the erection of a separate power station for the General Public Hospital.

The Motor Products Corporation of which W. C. Rand of the Rand Mfg. Company of Detroit is interested, will build a plant at Walkerville, Ont.

The City Council of Hamilton, Ont., is having plans prepared for an addition to the waterworks pumping plant to cost \$70,000. James Bain is the engineer.

A quantity of machinery will be installed in the new buildings which will be erected by the O'Brien Munition, Ltd., Renfrew, Ont., at a cost of \$6,500.

The Pembroke Electric Light Company, Pembroke, Ont., will build a brick and reinforced concrete sub-station at a cost of \$303,000.

The Toronto-Niagara Power Company, Thorold, Ont., is building a transformer house at a cost of \$100,000.

Nesbitt & Co., 10,243 Ninety-fifth Street, Edmonton, Alberta, have been awarded the contract for the erection of a machine shop at Edmonton for the Canadian Northern Railway at a cost of \$19,500.

The Dominion Construction Company, 14 Wellington Street East, Toronto, has been awarded the contract for the erection of a factory for the Goodyear Tire & Rubber Company, 152 Simcoe Street, Toronto, at New Toronto, Ont., at a cost of \$750,000.

The Canadian Briscoe Company has taken over the plant of the Brockville Electric Light Company at Brockville, Ont., and will convert it into a plant for the manufacture of steel parts for automobiles. The Canadian Briscoe Company is a subsidiary of the Carriage Factories, Ltd., of Brockville.

Davis & Fraser, Charlottetown, P. E. I., are having plans prepared by Chappell & Hunter, Des Bresay Block, for an addition to the boiler room of the company to cost \$6,000.

H. G. James, White Block, Sherbrooke, Que., is preparing plans for additions to a machine shop, of concrete and steel, to cost \$70,000.

The Manitoba Power, Pulp & Paper Company, Winnipeg, Man., proposes to erect a sawmill this year at Grand Rapids, Man., and pulp and paper plants in 1917. The estimated cost of the undertaking is \$2,000,000.

The Sydney Foundry & Machine Company, Sydney, N. S., will commence at once the erection of a marine repair shop and slip, to be followed later by the construction of a dry-dock. W. E. Clark is manager.

The Kaufman Rubber Company, Berlin, Ont., is in the market for a 250-volt direct-current generator of about 100 kw., direct-connected to a steam engine.

Delfosse & Co., 249 Craig Street, Montreal, are in the market for an electric motor, 10 to 15 hp., direct or alternating current.

C. W. Helwig & Sons, Neustadt, Ont., are in the market for a rotary pump, belt drive, 1¼ or 1½-in. intake and with 1¼-in. discharge.

William Hood & Son, 10 Richmond Square, Montreal, are in the market for a 10 or 15-hp. electric motor, a heavy Bliss trimming or punching press, a power hacksaw, and a 1000 to 2000-lb. drop forging hammer.

The Mueller Mfg. Company, Sarnia, Ont., has received a contract from a munitions company in the United States to supply brass forgings for time fuses. The Mueller Company is already supplying many Canadian firms with these forgings.

The wood-turning plant owned by Ewing & Murphy, Cameron Street, Toronto, was destroyed by fire with a loss of \$12,000, including some machinery. Richard Ewing is manager.

La Campagnie d'Automobiles Agricoles Bruneau, Ltd., Danville, Que., has been incorporated with a capital stock of \$100,000 by Ephrem T. Bruneau, George N. Letendre, Danville, Que.; Ferdinand P. Bruneau, Athabaska, Que.; Joseph Martel, Asbestos, Que., and others to manufacture motors, automobiles, etc.

The Ottawa Paint Works, Ltd., Ottawa, Ont., has been incorporated with a capital stock of \$250,000 by Thomas C. Hickman, John M. Young, George D. Kelley and others to manufacture paints, varnishes, brushes, etc.

Government Purchases

WASHINGTON, D. C., July 31, 1916.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until date not set, schedule 9840, for one apparatus for manufacturing oxygen and hydrogen, for Washington.

The lighthouse inspector, Boston, will receive bids until 2 p. m., Aug. 10, for one horizontal oil engine.

The chief of the Bureau of Yards and Docks, Navy Department, Washington, will receive sealed proposals until 11 a. m., Sept. 2, for an ice-making and cold-storage plant for the United States barracks, Pekin, China.

Bids were received by the Bureau of Supplies and Accounts, Navy Department, July 25, for supplies for the naval service as follows:

Schedule 9824, Steam Engineering

Class 11, Norfolk—Two 14-in. main circulating pumps, with spares—Bid 24, \$5,684 and \$5,484; 151, \$5,400.

Class 12, Mare Island—Two 14-in. main circulating pumps, with spares—Bid 24, \$5,724 and \$5,524; 151, \$5,480.

Schedule 9825, Steam Engineering

Class 13, ten lathe chucks and 2 sets of 4-face plate jaws for deliveries as follows:

Bid A—San Francisco—Bid 75, \$671.10 and \$685.80.

Bid B—New York—Bid 63, \$480.20, part; 75, \$611.45 and \$623.80; 98, \$582; 130, \$133.40.

Schedule 9828, Steam Engineering

Class 14, Puget Sound—One lathe—Bid 62, \$245; 99, \$282.50; 139, \$305.84.

Schedule 9859, Yards and Docks

Class 51, New York and Guantanamo—One gasoline-engine-driven fire pump. Bid 24, \$2,090; 76, \$2,990; 151, \$2,105.

Schedule 9860, Yards and Docks

Class 52, Philadelphia—One horizontal centrifugal pump—Bid 9, \$1,615; 24, \$2,190, \$2,290 and \$2,390; 44, \$1,490 and \$1,298.50; 45, \$1,509 and \$1,239; 51, \$1,718; 76, \$1,295; 78, \$1,538.50; 100, \$1,358 and \$1,215; 151, \$1,792 and \$1,717.

Schedule 9861, Yards and Docks

Class 53, Brooklyn—One hydraulic accumulator—Bid 161, \$2,250.45.

Schedule 9862, Construction and Repair

Class 61—Furnishing and installing one oil-burning forge furnace at Brooklyn (N. Y.) yard—Bid 7, \$1,370; 91, \$1,230 and \$1,705; 121, informal; 144, informal, \$2,650.

The names of the bidders and the numbers under which they are designated in the above list are as follows:

Bid 7, American Ship Equipment Company; 9, Alberger Pump & Condenser Company; 24, A. S. Cameron Steam Pump Works; 44, Erie Pump & Equipment Company; 45, Earle Gear & Machine Company; 51, Fairbanks, Morse & Co.; 62, Hallidie Machinery Company; 63, The E. Horton & Son Company; 75, Kemp Machinery Company; 76, R. M. Klein; 78, Lea-Courtenay Company; 91, Mirco Fuel Oil Equipment Company, Inc.; 98, Manhattan Supply Company; 99, Manning, Maxwell & Moore, Inc.; 100, L. B. Merritt & Co.; 121, W. S. Rockwell Company; 130, Southern Sales Company; 139, South Bend Lathe Works; 144, Tate, Jones & Co.; 151, Worthington Pump & Machinery Corporation; 161, Watson-Stillman Company.

